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MAMMALIA.

By BALDWIN SPENCER, M.A., C.M.Z.S., Professor of Biology
in the Melbourne University.

(PLATES 1, 2, 3, 4).

Whilst many workers, such as Gould, Waterhouse, Gray, Ogilby and others. have dealt with and described mammals occurring in Central Australia, there has been as yet scarcely any attempt to draw up a detailed list of the mammalian fauna of this part of the continent. The number of mammals brought back by the early explorers—owing to the insuperable difficulties in the way of making collections whilst traversing with horses the arid interior—was naturally but small.

In recent years the Elder Expedition brought back a small collection of some twenty specimens, which were described by Messrs. Stirling and Zietz* and referred to the following eight species:—*Myrmecobius fasciatus*, *Trichosurus vulpecula*, *Lagorchestes hirsutus*, *Onychogale lunata*, *Petrogale lateralis*, *Macropus robustus*, *Hapalotis mitchelli*, *Mus albocinereus* (?).

The most extensive list is that given by E. B. Sanger,† who states that, after two years' sojourn in the central districts, the following were all the mammals that he met with:—Chiroptera—*Scotophilus mori*. Rodentia—*Hapalotis conditor*, *H. cervina*, *H. mitchelli*, *Mus vellerosus*, *Hydromys fulvolovatus*. Carnivora—*Canis dingo*. Marsupialia—*Osphranter rufus*, *Onychogale lunata*, *Bettongia grayi*, *Perameles fasciatus*, *Peragale lagotis*, *Chæropus castanotis*, *Phalangista sp.*

As Mr. Sanger says:—"The physical conditions of the interior of Australia are not such as to support a varied fauna." More especially is this true in the case of the mammalia. A frog or a mollusc may tide over months of drought, a mammal cannot usually do so, and hence the mammalian fauna of such an arid region must consist of two elements—(1) a small number of forms able to travel long distances with comparative ease, such as the kangaroo or dingo, and (2) a

* Trans. R.S. South Aust., vol. xvi., p. 154.

† American Naturalist, vol. xviii., 1884, p. 9. I am much indebted to Mr. J. J. Fletcher for his kindness in drawing my attention to this article and providing me with a copy of it, as it was unprocurable in Melbourne.

larger number of smaller and usually burrowing animals capable of living for long with very little water to drink, and able to feed upon insects such as ants or the parched-up vegetation growing on the rocks and sand-hills.

The fauna must also vary very much according to the succession of seasons. A year or two of drought will thin out the animal population to a wonderful extent, and this thinning out can only be made good again by increased fertility and by immigration following upon one or two good seasons.

Anyone who has seen the central desert will realise at once how effectual a barrier to migration it affords to very many forms of life, the result being that a line of division can be drawn separating, as Professor Tate has pointed out, the Eremian region of the centre from the Autochthonian in the south-west and the Euronotian in the east and south-east. Around the true Eremian region runs a broad belt in the north, east, and south-east, over which the rainfall is less than twenty-five inches per annum. To the south-west lies a similar, only much narrower, band. To this matter reference will be made again when dealing with the marsupial fauna.

The mammalia of the central or Eremian region are representative of the five orders found elsewhere in Australia.

(1) *Carnivora*.—The dingo (*Canis dingo*) is fairly numerous. Most of the specimens seen were of the yellow-brown colour, but occasionally they were black. We met with them everywhere, and they seem to wander far out into the sand-hill country, as one followed us at dusk across Lake Amadeus. Near to the latter the dead bodies of five were found polluting the water of a native well at the bottom of a hole some twelve feet deep, into which they had evidently ventured in search of water, and out of which they had been too weak to climb. They probably feed upon marsupials, such as the rat-kangaroo (*Bettongia lesueuri*), which is not rare upon the sand-hills.

(2) *Rodentia*.—At certain times the country appears to be over-run by migratory rats, who travel in vast hordes, appearing and disappearing with strange suddenness. At ordinary times perhaps the most common mammals are the small jerboa-rats (*Hapalotis mitchelli*) and the mouse (*Mus novae-hollandiae*?). They are met with everywhere in the plain country. Though we did not meet with it, another species of *Hapalotis* (*H. conditor*) has often been recorded from the central parts. This owes its specific name to the fact that one or two families construct a nest built out of sticks firmly put together in a somewhat beehive shape at the base of a shrub.

(3) *Chiroptera*.—The most striking form amongst the bats is the large *Megaderma gigas*, Dobson. It is very local in its distribution, and, like many other forms in Central Australia, the numbers in which it occurs vary from season to season. Usually it is to be easily secured hiding during the day time in a cave amongst the McDonnell Ranges near to Alice Springs, but at the time of our visit this cave had been partially filled up and the bats had taken refuge somewhere else, so that only a single specimen was obtained. The size and general grey-white colour of the animal, together with the pink tinge on the ears and nose leaf, render it a striking object when seen alive.

The commonest form of bat which is met with everywhere flying about at evening is *Nictophilus timoriensis*.

(4) *Marsupialia*.—Of the six families found in Australia five are represented in the central area. One (Notoryctidæ) is represented by a single genus and species and is confined to it; another, Phalangeridæ, is represented by a single species, while the family Phascologyidæ is not represented.

The exact northern limit of *Phascologymys latifrons* is not defined, but apparently its distribution does not extend into the more northern parts of South Australia. The most northerly recorded locality is apparently Port Augusta.

The absence of the Phalangeridæ—except in regard to the ubiquitous *Trichosurus vulpecula*, the common so-called opossum—is easily understood, as the family is distinctly an arboreal one, inhabiting, as a general rule, well wooded districts where the rainfall is more regular than in Central Australia. The common *Trichosurus vulpecula* is probably the most widely-dispersed of all the Australian marsupials, and the most able—judging from the way in which it does so—to adapt itself to varying conditions of environment, though as yet it has not been recorded from the York Peninsula.

Except as forming a fringe for the river* beds in Central Australia there is no real woodland district, and hence it is not surprising that the family Phalangeridæ, which is especially a woodland one, is scarcely represented in the interior.

With the single exception of *Notoryctes typhlops* mentioned above, there cannot be said to be any important marsupial type which is confined to the Eremian region.

* It may be as well to say that the rivers which figure in maps of Central Australia only "run" at considerable intervals of time, between which—except for rare water-holes—they are perfectly dry.

The marsupial fauna is characterised, as might have been expected, by (1) the absence of almost all forms characteristic of the coastal and well-watered parts of the continent—that is, the Euronotian district ; (2) by the presence of a few forms confined to the district ; (3) by the predominance of other forms which are found in the inland parts of Queensland, New South Wales, Victoria, South and West Australia—that is, forms inhabiting the broad band of country previously referred to as surrounding the Eremian region on almost all sides. So far as the marsupials are concerned, this is a well-marked region. (4) By the presence of a few forms such as *Trichosurus vulpecula*, *Sminthopsis crassicaudata*, and *S. murina*, which appear to be universally, or nearly so, distributed over the continent.

A glance at the distribution of the species now recorded will show that there is only one of them which is as yet known only from the eastern side of the Eremian region and not also from the south and west. This is the rare *Antechinomys laniger*, which has been found in the inland parts of Queensland and New South Wales. There can, however, be little doubt but that the range of this extends into West Australia. It will be seen on the other hand that there is a strong predominance of South and West Australian species, together with a smaller number of forms, inhabiting these districts as well as the inland parts of Queensland and New South Wales and, to a lesser extent, the northern parts of Victoria.

So far as is at present known thirteen genera are represented, six of which belong to the Diprotodontia and seven to the Polyprotodontia. The thirteen genera are represented by eighteen species, of which seven belong to the Diprotodontia and eleven to the Polyprotodontia. To compare these numbers with the total number for Australia, including Tasmania, we find that of the Diprotodontia some twenty-four per cent. of the genera and seven of the species are represented, and of the Polyprotodontia some sixty-three per cent. of the total number of genera and twenty-five per cent. of the species. This proportionate representation in both cases is more closely similar to that of Tasmania than to that of any other division of the Australian region, and yet no two parts form a greater contrast to one another at the present day than do Central Australia and Tasmania. Whilst the latter owes its comparative poverty of diprotodont marsupials to the fact of its separation from the mainland before the period of their full development, the case is quite different with regard to Central Australia. In the latter the finding of abundant remains of extinct diprotodonts, some of huge size, has shown that at a former period it was the home of a fauna dependent upon a plentiful and constant vegetation such as does not now exist.

The changes resulting in the loss of humidity and the comparatively rapid drying-up and conversion of the country into a more or less arid region went hand-in-hand with the extinction of the old fauna. It is scarcely possible to imagine that many of the mammals would be able to accommodate themselves to such a complete reversal of climatic conditions as evidently took place in Central Australia, and more especially in the southern, central, and western parts, which now form what Professor Tate has called the Eremian region.*

It was at this time, when the physiographic conditions of the continent became changed, that the distribution of the marsupial fauna, as we now find it, must have been determined, at all events in its broad outlines.

The remains of extinct diprotodonts, evidently existing in large numbers, show that there must have been a very considerable land area in the central parts suitable for habitation, and in all probability affording a means of communication between the eastern and western parts of the continent. This diprotodont fauna probably spread across from the east to the west, and thus Western Australia received the ancestors of its present diprotodonts. Climatic changes in Tertiary times led to the drying-up of the central and western parts of the continent, until finally these parts became to a large extent waterless; surrounding them was formed a broad belt of comparatively dry country, whilst the humid and more fertile parts were confined to the littoral regions rising inland into mountain ranges and running along the north, east and south-east coasts. To this Professor Tate has given the name of Euronotian region. In the south-west lies a similar district—the Autochthonian.

So far as the marsupial fauna is concerned we can divide Australia into two main regions, the first of which corresponds to the Euronotian region, while the second includes the remainder of the continent. The Autochthonian region, which is so strongly marked in the case of plants, cannot, so far as marsupials are concerned, be regarded as distinct. It has certainly a few distinctive forms, but these are principally to be found amongst the more specialised diprotodonts. Its marsupial fauna in no way stands in the same relationship to that of the rest of the continent as does its flora. So far as it is known it is closely allied to that of the great mass of country which stretches right across to the inland boundary of the Euronotian region.

There is again no distinctive Eremian marsupial fauna, but there is, on the other hand, a very distinct one which is characteristic of the broad belt of country in which the rainfall is between ten and twenty five inches yearly.

* Aust. Ass. Adv. Sci., Sydney, 1888, vol. i. Presidential Address to the Biological Section, p. 312, pl. xviii.

This belt of country includes the greater part of Queensland and New South Wales and a portion of Victoria, the southern part of South Australia and the inland part of West Australia which borders the central desert from Eucla in the east, on the Great Australian Bight, to Shark Bay on the western coast line.

It is separated from the Euronotian by both positive and negative characters. Certain genera, such as *Myrmecobius*, *Chæropus*, *Peragale*, and *Antechinomys*, together with numerous species of other genera, are found in it, but not in the Euronotian region, in which, on the other hand, are still more numerous genera and species not met with in the inland country. To pass from the coastal district over the ranges into the inland parts anywhere along the southern and eastern part of the continent is not only to leave behind a rich variety of forms, but to be brought into contact with a quite different series, often of genera and, to a very large degree, of species of marsupials, birds, reptiles, and fishes.

There is really in Australia a primary division of marsupials into two groups:—

(1.) Those which require an environment dependent upon and resulting from a constant rainfall of twenty-five inches and upwards yearly, and which inhabit the Euronotian region.

(2.) Those which have become modified so as to be fitted to an environment dependent upon and resulting from a rainfall of less than twenty-five inches yearly. These practically inhabit the remainder of the continent.

As a sub-division of these, a certain number of forms may be grouped together which can exist under the more rigorous conditions of a climate in which the rainfall is under ten inches yearly, and it is these which form the marsupial fauna of Central Australia. This central marsupial fauna is essentially an immigrant one, of comparatively recent date, and the immigration appears to have taken place in the main from the southern and western borders.

To summarise briefly. In times probably just preceding the Pleistocene there was a large and well-watered land area in Central Australia inhabited by a well-developed marsupial fauna. Across this central area migration took place in the main, and certainly so far as the diprotodonts are concerned, from east to west. In this way West Australia acquired its diprotodont fauna. Subsequently the central area became transformed into a dry, arid region, in which condition it has remained until the present day.

There must, judging by the presence of such species as *Macropus eugenii* in Kangaroo Island, have been for some time an extension of land to the south of the continent stretching across what is now the Great Australian Bight.

There then followed, in some cases, a differentiation of forms separated by the central area, resulting for example in the existing *M. eugenii* on the west and its close ally, *M. parma*, on the east. In the case of *M. robustus* we have an example of a form which either was able to maintain its existence despite the change in climate or else migrated subsequently from the north-east.

Following upon the extinction in the central area of the greater part of its marsupial fauna, there ensued a migration of such forms as could live in an arid region, and the differentiation of a certain number such as *Dasyuroides byrnei*, *Phas. macdonnellensis*, *Sminthopsis psammophilus*, *S. larapinta*, and others not yet discovered. The one form which is at once the most modified and pre-eminently distinctive of this region is *Notoryctes typhlops*.

The following table indicates the distribution of the marsupials known from Central Australia† :—

	W.A.	S.A.	Int. N.S.W.	Coast N.S.W.	Int. Q.	Coast Q.	North. Territ.	Int. Vict.	Coast Vict.
<i>Macropus rufus</i> - - -	X ?	X	X						
<i>Macropus robustus</i> - - -		X	X				X		
<i>Petrogale lateralis</i> - - -	X								
<i>Onychogale lunata</i> - - -	X	X							
<i>Lagorchestes conspicillatus</i> (var. <i>leichardtii</i>) - - -	X								
<i>Bettongia lesueuri</i> - - -	X	X							
<i>Trichosurus vulpecula</i> - - -	X	X	X	X	X	X	X	X	X
<i>Peragale lagotis</i> - - -	X	X							
<i>Chceropus castanotis</i> - - -	X	X	X				X	X	
<i>Phascologale cristicauda</i> - - -		X							
<i>Phascologale calura</i> - - -	X	X							
* <i>Phascologale macdonnellensis</i> - - -									
<i>Sminthopsis murina</i> - - -	X	X	X	X	X	X		X	X
<i>Sminthopsis crassicaudata</i> - - -	X	X	X	X	X	X		X	X
* <i>Sminthopsis psammophilus</i> - - -									
* <i>Sminthopsis larapinta</i> - - -									
* <i>Dasyuroides byrnei</i> - - -									
<i>Antechinomys laniger</i> - - -			X		X				
* <i>Notoryctes typhlops</i> - - -									

* Those marked with an asterisk are peculiar to Central Australia so far as at present known.

† In addition to those named in this list, there certainly exist in Central Australia a species of *Dasyurus* and at least one of *Perameles*. Mr. Gillen informs me that at Alice Springs the blacks have a special corroboree associated with the "Chilperta," or native cat. *Perameles fasciatus* is included in Sanger's list, and Mr. Byrne, of Charlotte Waters, who is well acquainted with the marsupial fauna of that district, tells me that he knows of the existence of one species of *Perameles*, and believes that a species of *Peragale* occurs of considerably smaller size than, and distinct from, *P. lagotis*.

(5) *Monotremata*.—As might have been expected, the family Ornithorhynchidae is not represented in the Eremian region at the present time. The only permanent waters are rocky holes amongst the ranges, and these are unfit for habitation by Ornithorhynchus. The family Echidnidae, on the other hand, has a wide distribution amongst the rocky hills, being certainly found at Barrow Creek in the north and Charlotte Waters in the south. Those from the former district are stated to be remarkably small; but those from the latter, though very much smaller than the largest specimens known from Queensland, are still of medium size.

The following is a list of the mammals secured, the various species of which are dealt with separately:—

Sub-class EUTHERIA.

Order **Carnivora**.

Family CANIDÆ.

- (1) *Canis dingo*.

Order **Rodentia**.*

Family MURIDÆ.

- (1) *Hapalotis mitchelli*.
 (2) *Hapalotis apicalis*.
 (3) *Hapalotis cervinus*.

Order **Chiroptera**.

Family NYCTERIDÆ.

- (1) *Megaderma gigas*.

Family VESPERTILIONIDÆ.

- (1) *Nyctophilus timoriensis*.

Sub-class METATHERIA.

Order **Marsupialia**.

Sub-order DIPROTODONTIA.

Family MACROPODIDÆ.

* The collection also includes species of the genus *Mus*, as yet undetermined.

Sub-family Macropodinae.

- (1) *Macropus rufus*.
- (2) *Macropus robustus*.
- (3) *Petrogale lateralis*.
- (3) *Lagorchestes conspicillatus*, var. *leichardti*.
- (5) *Onychogale lunata*.

Sub-family Potoroinae.

- (1) *Bettongia lesueuri*.

Family PHALANGERIDÆ.

Sub-family Phalangerinae.

- (1) *Trichosurus vulpecula*, var. *typica*.

Sub-order POLYPROTODONTIA.

Family PERAMELIDÆ.

- (1) *Peragale lagotis*.
- (2) *Chwropus castanotis*.

Family DASYURIDÆ.

Sub-family Dasyurinae.

- (1) *Phascologale cristicauda*.
- (2) *Phascologale macdonnellensis*.
- (3) *Phascologale calura*.
- (4) *Sminthopsis crassicaudata*.
- (5) *Sminthopsis murina*.
- (6) *Sminthopsis larapinta*.
- (7) *Sminthopsis psammophilus*.
- (8) *Dasyuroides byrnei*.
- (9) *Antechinomys laniger*.

Family NOTORYCTIDÆ.

- (1) *Notoryctes typhlops*.

Sub-class PROTOTHERIA.

Order Monotremata.

Family ECHIDNIDÆ.

- (1) *Echidna aculeata*, var. *typica*.

Order **Carnivora.**

Family CANIDÆ.

(1) *Canis dingo.*

This appears to be universally distributed, occurring in the ranges, on the stony plains, and amongst the sand-hills.

Order **Rodentia.**(1) *Hapalotis mitchelli*, Ogilby. Mitchell's jerboa-rat.

This is the commonest form of jerboa-rat in the central districts, where it forms burrows in the sandy, plain country amongst the scrubs formed by mulga (*Acacia aneura*), desert oak (*Casuarina decaisneana*), and such smaller shrubs as various species of *Eremophila* and *Cassia*. The small entrance to the burrow is not indicated by any mound, but is simply a hole in the earth, sometimes on the open ground, at others close to the root of a shrub and just large enough to admit the body of the animal. The burrow may go down for a depth of three or four feet. In each burrow lives apparently a pair of animals, and when young ones are present a rough nest is formed of cut pieces of grass-stalks. In one burrow we found an adult female with four very young and five larger young ones, evidently two successive broods, and in another an adult female with four large young ones. These numbers indicate the number of young produced at one birth. They are nocturnal in their habits, burrowing in search of food at the bases of shrubs, and can only be obtained by digging during the daytime.

Ogilby,* in speaking of *Hapalotis albipes*, quotes certain remarks of Sir George Grey with regard to the manner in which that species carries its young. The latter writer says:—"The mother has no pouch, but the young attach themselves with the same or even greater tenacity than is observable in the young of *Marsupiatæ*." Ogilby states that he has failed to elicit any further information, either confirmatory or rebutting, from zoologists on this subject. At all events, in *H. mitchelli* there is no such attachment of the young to the teats, and though the very small young ones were being suckled, the mother, when disturbed, attempted to escape, leaving the young ones behind.

The native name at Charlotte Waters is Ulabaiya.†

Habitat.—South, West, and Central Australia.

* Catalogue of Australian Mammals, Sydney Museum, 1892, p. 115.

† I insert the native names, as these are very useful when collecting amongst the blacks. To secure many animals, especially the burrowing nocturnal forms, the assistance of the blacks is indispensable.

(2) *Hapalotis apicalis*, Gould. The white-tipped jerboa-rat.

This is evidently a comparatively rare form, and is considerably larger in size than *H. mitchelli*.

I am indebted to Mr. Gillen for an adult male and to Mr. Field for an immature male specimen. Both of them came from Alice Springs.

(3) *Hapalotis cervinus*, Gould. Fawn-coloured jerboa-rat.

We did not secure any specimen of this during the Expedition, nor were any to be found some months later during February, 1895, when I again visited Charlotte Waters; but Mr. Byrne kindly sent me down three specimens secured in June and July, 1895, when they had for some reason become plentiful, following upon a good rain season. Mr. Byrne, writing from Charlotte Waters in July, referring to this species, says:—"The jerboa-like rodents are coming from the eastwards, and they almost amount to a plague here," and, writing again in September, says that they have again become so scarce that the blacks have difficulty in securing a specimen.

This migration of rodents in Central Australia appears to be dependent entirely upon the occurrence of good seasons, and with the advent of these is not an uncommon occurrence.

Order **Chiroptera.**

Family NYCTERIDÆ.

(1) *Megaderma gigas*, Dobson.

Only a single specimen of this was obtained at Alice Springs from a cave in the McDonnell Ranges; subsequently, through the kindness of Mr. F. J. Gillen, I obtained two more. At times they are met with in abundance in this locality, and are evidently confined to the central part of the continent.

Habitat.—Central Queensland and Alice Springs.

(2) *Nyctophilus timoriensis*, Geoffroy.

This is the commonest species of bat, being met with everywhere in the central district.

Habitat.—The Australian region.

Order Marsupialia.

Sub-order DIPROTODONTIA.

Family MACROPODIDÆ.

Sub-family Macropodinæ.

(1) *Macropus rufus*, Desmarest. The red kangaroo.

The numbers in which this, as other forms of marsupials, are met with doubtless varies with the seasons and the consequent amount and quality of food available. Mr. Sanger says—"This animal is but rarely seen, and only after a heavy rain, when there is plenty of vegetation for it to feed upon. Towards the confines of the desert it is more numerous." We saw it frequently in small numbers throughout all the plain districts, just as the Euro (*M. robustus*) is met with amongst the ranges. We never saw more than ten or twelve feeding together; amongst these would be two or three large rufous-coloured males, while the rest would be smaller blue-grey females and young ones.

It was seen everywhere in the plains from Mt. Olga, lying south of Lake Amadeus, to the Burt Plains, lying north of the McDonnell Ranges, and in all the intervening country. In a note with regard to the specimens in the British Museum collection, to which the locality of West Australia is attached, Mr. Thomas says that probably this is incorrect, as no other record exists of the occurrence of *M. rufus* there, and Gould states that it is not found west of South Australia. At Mt. Olga we were not very far away from West Australia, and the same class of country, stretches right across into the latter. As *Macropus rufus* is the characteristic kangaroo of this country, there can be no doubt whatever that its range does extend into the inland parts of West Australia.

The following notes refer to two skulls brought back:—The first is that of an "aged" animal from the Horn valley amongst the McDonnell Ranges. The upper incisors have very little enamel-covered portion left. m^1 is worn down to a mere shell. No transverse anterior ridge is left in m^1 or m^2 . In m^3 the anterior transverse ridge is worn down until it shows a union in the middle with the large ridge behind.

In the lower jaw m^1 is very small and nearly worn away. The left anterior palatal foramen is 15.5 mm. long, the right foramen is only 11 mm., showing thus a difference of 4.5 mm. in length between the two.

Nasals.—Greatest length, 72 mm.; least combined width (in middle), 18 mm.; greatest combined width (at the posterior end), 28 mm.

The second specimen is that of an "adult" animal from Ayers Rock. The fourth molar in each jaw is not yet completely cut through. In the upper jaw the space between the roots of i^1 on each side is 5 mm. The enamel-covered part of i^2 is 9 mm. high and 5 mm. broad. The antero-posterior dimension of i^3 is 9.5 mm. There is a fairly well-marked single groove. There are no central connecting ridges to the anterior transverse ridges of the molars.

The anterior palatal foramina measure 13 mm. in length, reaching well back to the suture between the maxillæ and premaxillæ. The greatest length of the nasals is 70 mm.; least combined width (in middle), 15 mm.; greatest combined width (at the posterior end), 34.25 mm.

The colour markings of the animal agree with those of *M. rufus*, to which the animal may be undoubtedly referred. The molar teeth, as seen in the "adult" specimen are those characteristic of the species, with which they also agree in the length of the anterior palatal foramina. i^3 is longer than the same tooth in the typical *M. rufus*, and more resembles that of *M. giganteus*, though in the presence of only one notch it still more closely resembles that described in *M. antilopinus*.

The most important difference which they show when compared with the typical skull dimensions, as given by Mr. Thomas, is in regard to the nasals.

In *M. rufus* these are described as "very long, narrow, parallel-sided, their middle width going from 4 to $4\frac{1}{2}$ times into their length." In *M. giganteus* the nasals are described as "broadening behind." The dimensions given above show that the relation between the least width and the length of the nasals is that given by Mr. Thomas, but that there is a most marked broadening behind, and, further, that there is a great difference in this respect between the two specimens. In the second the posterior is more than twice the median width.

Evidently there are, as shown in the case of i^3 , the anterior palatal foramina and the nasals considerable variations to be found within the limits of the species, and it may not be at all unlikely that such forms as *M. antilopinus*, *M. isabellinus*, and *M. magnus* will turn out to be simply varieties of the form *M. rufus*, which is widely distributed through the central parts of the continent.

Habitat.—The inland parts of New South Wales and South Australia, and the whole central area from the south of Lake Amadeus to the Burt Plains north of the McDonnell Ranges. As stated above, there can be no doubt but that its range extends across the desert into West Australia.

(2) *Macropus robustus*, Gould. The Euro.

This is the "Wallaroo" of Queensland and the inland parts of New South Wales and the "Euro" of South Australia, specimens from which were formerly described as belonging to a distinct species (*M. erubescens*). In the British Museum Catalogue Mr. Thomas says:—"I cannot distinguish specifically the kangaroo described as *M. erubescens*, which seems to be merely a more rufous form of the present species. As to colour, every intermediate gradation appears to occur, and the skulls of the two forms are quite identical. In a general way South Australian specimens belonging to "*erubescens*," and New South Wales ones to "*robustus*," but specimens agreeing with both are often found in one and the same place."

So far as colouration is concerned the Euros of Central Australia are strongly suffused with rufous, and the blacker forms characteristic of the animal known locally in Queensland and New South Wales as the "Wallaroo" do not occur. The intermingling of the two colour varieties referred to by Mr. Thomas must take place somewhere to the east of the central district, the mountain ranges of which are separated by considerable tracts of plain and desert country from the ranges of the eastern parts in which the wallaroo is found.

This species is exclusively confined to the rocky hills, and is apparently never met with in the plain country inhabited by *Macropus rufus*.

The native name is Cünüla.

Habitat.—Its range is very wide, extending right across the continent from the head of Spencer Gulf to the "far north." On the eastern side of the central area it is found in the inland parts of New South Wales and Queensland. Its western limit is not known, but it certainly extends as far as the western end of the McDonnell Ranges, and probably will be found in all the hill ranges of Central and also inland West Australia.

There is thus in the Eremian region one species of *Macropus* characteristic of the plain country and another of the hills. Both of them are also characteristic forms of the border-land between the former and the Euronotian region into which they do not extend.

(3) *Petrogale lateralis*, Gould. The West Australian rock-wallaby.

This is the common rock-wallaby of the central districts, living among the rocks along with the Euro (*Macropus robustus*).

Of five specimens secured at Paisley Bluff, in the McDonnell Ranges, four were females, and each had a single, fairly-developed young one in the pouch. The teats are four in number. All the specimens seen were of the typical colouration.

In each of six skulls secured at Alice Springs (two "aged," two "adult," and two immature) there is only one premolar present on each side of each jaw. In the "aged" and "adult" specimens it belongs to the permanent and in the immature ones to the milk dentition.

In a young female specimen taken from the pouch, and in which i^3 is just appearing, there is also no trace of any third premolar.

The animal is plentiful in and confined to the rocky ranges, not coming down on to the plains. It is very shy and remarkably agile in its movements amongst the rocks.

Habitat.—It is not, as its popular name implies, by any means confined to West Australia, and is to be met with probably everywhere in the hill country of the central part of Australia. It is certainly to be found amongst the ranges of the central part drained by the Finke and Todd rivers and their tributaries, and was also secured by the Elder Expedition in the Barrow Ranges.

(4) *Lagorchestes conspicillatus, var. leichardti*, Gould. The spectacled hare-wallaby.

Though far from uncommon, only one specimen of the continental variety of the spectacled hare-wallaby, known as Leichardt's hare-wallaby, was caught. It was secured in a spring-trap at night amongst sandy country, close to a camp at the base of Mt. Sonder in the McDonnell Ranges. It is apparently (Kreff) a solitary-living and nocturnal animal, and we never saw it about during the day-time. The fact that during the greater part of our time the thermometer fell at night to a very low temperature, often below freezing-point, will probably account for the fact that nocturnal animals were only rarely to be secured. Unfortunately the skull of the specimen was stolen one night from camp by a dingo, and for purposes of recognising the species only the skin remained. The following are the measurements of the skin, the bones having been left in the legs :—

Length of body and head	...	...	470 mm.
Tail	...	...	400 "
Hind foot	...	...	153 "
Ear	...	...	42 "

The colouration agrees with that of the variety *leichardti*, but it will be seen on comparison with the measurements given by Mr. Thomas* that both the hind-foot and the ear are proportionately considerably longer than in the typical form. At the same time the ear, as in *L. conspicillatus*, is less than one-third the length of the hind-foot.

Habitat.—The range of the variety is usually stated as North Australia, but it certainly occurs in the central districts, and, as Mr. Thomas says, "is probably spread over the whole of Central and North-western tropical Australia." The southern limit of its range is not known, but it certainly occurs south of the tropics.

Messrs. Stirling and Zietz record *L. hirsutus*, the Western Australian species, amongst the mammals of the Elder Expedition, and Mr. Streich informed them that it appeared to be numerous in the northern parts of the Victoria Desert.

(5) *Onychogale lunata*, Gould. The crescent wallaby.

Two specimens, for which I am indebted to Mr. F. J. Gillen, were caught at Alice Springs. It has been recorded from Central Australia by Sanger,† and was captured in the Everard Ranges during the Elder Expedition.

Sub-family Potoroinæ.

(1) *Bettongia lesueuri*, Quoy and Gaimard.

This is the common sand-hill rat-kangaroo of Central Australia, and is perhaps, judging by the number and size of the excavations which it makes, the most common form of marsupial amongst the sandy plains and sand-hills, where we often saw it during the daytime, dodging with wonderful speed and agility in and out amongst the bushes and tussocks of porcupine grass.

This species seems to be especially a dry-country one.

The native name is Mäl-lä.

Habitat.—We found it during the whole course of the expedition, and there can be no doubt but that it is distributed right across South, Central and West Australia.

Family PHALANGERIDÆ.

Sub family Phalangerinæ.

(1) *Trichosurus vulpecula*, var. *typicus*, Kerr. The common phalanger.

This common phalanger is very widely distributed, occurring everywhere amongst the eucalypts which border the river-beds.

* British Museum Cat., p. 82.

† Am. Nat., vol. xviii., 1884.

In the skull of a male, in which in the lower jaw the permanent p^4 has carried up the milk p^1 , which still remains as a thin shell forming a cap on the permanent tooth, there is present between i^2 and p^1 on the left side a small tooth. Mr. Thomas* says that there is sometimes present in the lower jaw a minute tooth between i^2 and p^1 which probably represents p^3 . In this specimen the tooth in question is separated by a diastema of 1 mm. from i^2 , and by one of 2 mm. from p^1 , so that presumably it indicates a tooth anterior to p^1 . In the upper jaw the single tooth present between the canine and p^1 is separated from the former by a diastema of 1 mm., and from the latter by one of 3.5 mm.

In a second skull—that of a mature female—in the upper jaw there is on each side a diastema of 3.5 mm. between i^2 and the canine, of 3 mm. between the latter and the small tooth (p^1 ?), and of slightly less than 3 mm. between the latter and p^1 .

The native name is Wi-ōta.

Sub-order POLYPROTODONTIA.

Family PERAMELIDÆ.†

(1) *Peragale lagotis*, Reid. The rabbit-bandicoot.

This is not uncommon, judging by the number of tails used by the natives as ornaments. They tie the white terminal tufts together in bundles of from twelve to twenty.

It is to be found wherever the ground is suitable for its burrows.

The native name (Charlotte Waters) of the animal is Urgätä and of the tail Alpeeta.

Range.—Central, South and West Australia.

(2) *Cheropus castanotis*, Gray. The pig-footed bandicoot.

At the present time this is one of the most difficult of the smaller marsupials to secure. It is known to the natives by the name of "Dubaija," but during the expedition we were unable to secure a single specimen. On a subsequent visit to Charlotte Waters I was fortunate enough to obtain one secured by the blacks.

The dorsal surface, as in Western Australian specimens, is of a light, almost orange-brown, colour; the ventral surface is light fawn colour.

* Brit. Mus. Cat., p. 186.

† Since this was printed I have received from Mr. Byrne a species of *Perameles* and specimens indicating the existence of another species of *Peragale*, of smaller size than *P. lagotis* and of a darker colour.

The tail is considerably more than half as long as the body, with a terminal crest which, on the dorsal side, commences at about 70 mm. from the tip. At first the hairs of the crest are of a dark brown colour, but at the tip, where they measure 22 mm. in length, they are white. On the ventral surface there is also a smaller crest of white hairs, commencing at about 30 mm. from the tip and reaching a length of 12 mm.

The mammae as described are eight in number.

DIMENSIONS OF FEMALE (in al.).

Head and body	...	...	...	230 mm.
Tail	...	...	...	139 "
Muzzle to eye	...	...	...	34 "
Hind foot	...	...	...	69 "
Ear	...	...	...	54 "

Habitat.—The inland parts of Victoria and New South Wales, South and West Australia, and Central Australia. In the British Museum Catalogue the locality of Northern Territory is queried. There is no doubt but that the range of the animal extends widely over the central area. In the Adelaide Museum is a specimen from Barrow Creek, which lies well within the tropics, and throughout the whole of our expedition all the natives were well acquainted with it. My specimen was dug out of a hole in a sandy plain by a native black woman. Mr. Lydekker* has given an account of its habits derived from notes by Mitchell and Krefft. It appears to have been at one time fairly common in such parts as the Murray district, but is now very difficult to find, and is evidently rapidly becoming extinct, except perhaps in the more central districts.

Charopus is, again, one of the border-land forms of marsupials and not found in the Euronotian region.

Note.—In August I received from Mr. Byrne a female with two well-developed young in the pouch. These, judging from their size, must have been born not less than a month, probably the breeding-time was near to the end of June, though the date most likely varies to a certain extent with the nature of the seasons. This specimen was captured at Charlotte Waters, and is of considerably darker colour than the one described above.

* Marsupials and Monotremes, p. 147.

Family DASYURIDÆ.

Sub-family Dasyurinae.

(1) *Phascologale cristicauda*, Krefft. The crest-tailed Phascologale.

(Plate I., Figs. 1a, 1b. Plate IV., Figs. 5, 6, 7, 8).

The exact determination of this species is a matter of considerable difficulty. Through the kindness of Mr. Byrne I received some six adult and four immature specimens of what was apparently a species of *Phascologale* from Charlotte Waters, though at the same time it showed in the structure of the foot more the character of a *Sminthopsis*, rendering it a matter of some difficulty to which genus, as at present defined, it should be referred. All the specimens were females, half of them with young ones attached to the teats. On a subsequent visit to the same district I obtained, also through the kindness of Mr. Byrne, additional specimens, two of them being males. The latter are much less numerous than the females, and much more difficult to find. The blacks state that the male is never found in the same burrow with the female when the latter has young, but that they return later on. This may or may not be so, but blacks' statements on matters of natural and other history must be accepted with reserve, as they are not devoid of imagination or at all incapable of inventing an ingenious excuse to account for failures of capture.

All the specimens secured agreed fairly closely in size (that is, the adults) with the measurements given by Mr. Krefft for his single specimen of *Chaetocercus cristicauda*. The dentition showed the peculiarity of the latter in that the lower p^1 was always absent, its position being indicated by a slight diastema. In addition, the upper p^1 is also absent in the great majority of specimens. In the young ones it is never or very rarely present; in the adult form it is at most tubercular in shape, and generally wanting or present on one side only. Apparently there is no milk premolar. Mr. Krefft says:—"The third and last premolar of the upper jaw is very diminutive and tubercular."*

In relative dimensions the hind feet may be regarded as intermediate between those of a typical *Phascologale* and *Sminthopsis*. The footpads of the hind feet differ from those characteristic of the former in that the five typical striated pads are wanting. At the base of the toes are three granulated elevations, much as, for example, in *Sminthopsis murina*, each bearing an unstriated pad formed by the coalescence of certain of the granulations, but of regular form.

* "Mammals of Australia."

Unfortunately the foot-pads were not recorded by Mr. Krefft.

The black crest typical of the tail of *Ph. cristicauda* was present, but differed from that described by Krefft in being developed on the ventral as well as on the dorsal surface.

The peculiarity of the dentition, the crested tail, and the general measurements of the body led me to refer the animal to Krefft's species.

Mr. J. J. Fletcher very kindly, in response to my request, inspected and sent me a description of the type specimen, and subsequently, through the courtesy of Mr. R. Etheridge, jun., the curator of the Sydney Museum, to whose kindness I am much indebted, I had the opportunity of examining the specimen itself.

Unfortunately, as Krefft stated, the original, which came from "South Australia, probably the neighbourhood of Lake Alexandrina,"* was in a bad state of preservation when received. Very little could be made of it as a mounted specimen, and the taxidermist of that time (as Mr. Etheridge is also of opinion) evidently endeavoured to make amends for the lack of fur by inserting patches borrowed from some other beast of as nearly as possible the same colour and texture, but the result is not a success. There is, however, enough of the original fur and animal remaining to show that the figure† given by Krefft is exceedingly unsatisfactory.

The mounted specimen is nothing like so rufous in colour as the drawing represents, and has, moreover, a distinctly lighter under-surface. To replace the lost fur the taxidermist chose a more mouse-coloured one. In the plate (presumably drawn from the specimen or from notes provided by Mr. Krefft) the head is shown as flattened after the manner of a Phascologale; in the stuffed specimen it is distinctly rounded. The ear in the figure is too small. The tail of the mounted specimen is much more swollen out at the base than is represented in the figure, and has the appearance of being incrassate during life.‡ The most curious feature in regard to the tail, however, is the presence of black hairs forming a crest (they are matted together, but can be clearly seen) on the under-surface of the tip. These are neither mentioned in the description nor drawn in the figure, where the tail is most inaccurately represented, both in regard to the crest and general shape.

* Krefft: "Mammals of Australia." The pagination of this volume is irregular, and so cannot be referred to.

† P.Z.S., 1866, pl. 36.

‡ The original description and the figure given in the P.Z.S., 1866, differ somewhat from the description given by Krefft in his "Mammals of Australia." In the latter he says—"Tail thick, with compressed sides, ornamented by a crest of hair on the apical half, similar to the tail of the pig-footed bandicoot." It can only be said, in reference to this, that neither in the figure nor in the actual specimen itself is the tail like that of *Charopus castanotis*.

So far as I can judge, the tail of the specimen when received by Mr. Krefft must have been very similar to that of certain of the least well preserved specimens received by myself from the central district, where the heat is so great that, if the animal (as frequently happens of necessity) cannot be placed in spirits directly after capture, the skin rots and the fur comes out. How bad the skin of Mr. Krefft's specimen must have been is shown by the fact that one hind foot now measures 18 and the other 24 mm. The nature of the pads cannot unfortunately be determined.

Under the circumstances detailed above—an originally badly preserved type specimen, a drawing which could not in certain respects (as to the tail and colouration) have fairly represented the animal, and a description which is not only far from complete but is incorrect—there is considerable difficulty in assigning with certainty any newly found specimens to the species in question.

We have, however, the dimensions given by Mr. Krefft, the corrections in the description of the animal as to colour and form of the tail and its crest, which can be made after inspection of the type specimen, and the peculiarity noted in the dentition by Mr. Krefft.

A re-description, taking all these points into consideration, would apply so closely to the specimens recently obtained from Central Australia, that I have thought it better to amend the description as given by Mr. Krefft, and to place my specimens in the same species rather than to create a new one for their reception.

The amended description will read as follows:—

Phascogale cristicauda, Krefft.

Size large. Form strong. Fur close and soft, mainly composed of the under fur.

The general body colour is mouse grey tinged with rufous on the back. The under surface is white or cream coloured, and so are the inner and anterior faces of the limbs and the upper surfaces of the hands and feet. The under fur on the back is slate grey at the base and rufous terminally; on the ventral surface it is cream-white terminally.

The tail is thickly covered in its proximal half on the upper and lateral surfaces with coarse, chestnut coloured hairs; on the ventral aspect the hairs are dark brown in colour. About the middle of its length it is covered with coarse black hairs, which increase in length distally on the upper and under surface until,

especially on the upper surface, they form a distinct black crest, a smaller crest being present on the under-surface.* The tail is considerably swollen out proximally and somewhat incrassated, though the incrassation is hidden by the body hairs, which pass on to the root of the tail.

Ear when laid forward reaching to the posterior border of the eye. They are covered internally and externally with short, stiff hairs.

The eye is surrounded by a light ring of hairs.

Hairs on the fold of the pouch and in the pouch-area, where they are scanty, are white.

Hands and feet white or light grey above. Palms with six granulated elevations, each with a small unstriated pad.

There is a small tuft of white, whisker-like hairs on the posterior side of the fore-arm just above the wrist.

Soles of feet with three granulated elevations at the base of the toes, each with a small unstriated pad. The soles are hairy in the heel region and have a series of thick-set, strong hairs running along the outer and inner margins and bending over on to the under-surface, only the median part of which, so far back as the heel, is really naked. The median part is strongly granulated.

Pouch opening vertically downwards, with moderately-developed lateral folds.

Mammæ eight (may be reduced to six or rarely four).

DIMENSIONS.

			Mr. Krefft's Specimen.	Adult ♂ in al.	Adult ♀ in al.
Head and Body	-	-	121	148	130
Tail	-	-	83	89	85
Ear	-	-	—	15.5	15.5
Hind-foot, length	-	-	28	26	28
Dentition	<i>i.</i> $\frac{1.2.3.4}{1.2.3}$	<i>c.</i> $\frac{1}{1}$	<i>p.m.</i> $\frac{1.0.3.4}{1.0.3.0}$	<i>m.</i> $\frac{1.2.3.4}{1.2.3.4}$	

* This description of the tail, though considerably different from that given by Krefft, will still apply to his specimen, as he seems to have quite overlooked the small crest present on the under-surface.

In the upper jaw the first incisor is larger than the other three, and is separated from them by a diastema. The canine is large and strong and measures 3 mm. or even slightly more in length. P^2 is larger than P^1 , and P^1 , if present at all, is minute and tubercular and usually absent.

In the lower jaw the three incisors of each side are sub-equal, close together and to the canine, which is strong and measures 2.5 mm. in height. P^1 is quite wanting, and p^1 often lies close against m^1 or is separated from it by a slight diastema.

The following are the dimensions of the skull of an adult female:—

Basal length	...	...	...	...	34.5
Greatest breadth	...	...	...	...	23.5
Nasals, length	...	...	...	...	12
„ greatest breadth	...	...	...	...	5
„ least breadth	...	...	...	...	2.5
Intertemporal breadth	...	...	...	...	7
Palate, length	...	...	...	...	18
„ breadth between outer corners of m^1	...	...	...	...	11
Palatal foramen	...	...	...	...	5
Basal cranial axis	...	...	...	...	11
Basal facial axis	...	...	...	...	20
Facial index	...	...	...	...	142.8
Teeth, horizontal length of P^1	...	...	...	...	1
„ length ms^{1+2}	...	...	...	...	7.5
„ breadth m^1	...	...	...	...	2

Habitat.—South and Central Australia. Mr. Krefft's specimen probably came from Lake Alexandrina, though the exact locality is doubtful, mine from Charlotte Waters, Central Australia, with the exception of two immature males kindly sent to me by Mr. E. C. Cowle, who procured them at Ilamurta, in the James Range. To Messrs. Byrne and Cowle I am much indebted for their valuable assistance in securing specimens of this rare and interesting species.

The native name is Amperta.

The animal lives in burrows, which it lines with grass, in sandy and stony tablelands, thus forming another exception to the usual statement that the members of the genus *Phascologale* are exclusively arboreal.*

* *cf.* The description of *Ph. macdonnellensis*, an undoubted *Phascologale*.

The above will serve to define the species. It will be seen that in one important point, viz., the absence of the five striated pads upon the sole of the hind-foot, *Ph. cristicauda* differs from the other species referred to the genus; and if this character be insisted upon as essential, then it must be removed from the genus. On the other hand, the dentition, general form of the body, and the characters of the skull (especially in respect to the nasal bones and the swollen bullæ) are distinctly those of a Phascologale rather than a *Sminthopsis*. *Ph. cristicauda* may be best regarded perhaps as a form intermediate between the genera Phascologale and *Sminthopsis*, and as showing in its dentition, together with such other forms as *Ph. apicalis* and *Dasyuroides byrnei*, an approach towards the genus *Dasyurus*.

The following are the dimensions of twenty of the specimens in my collection, which will serve to give some idea of the individual variations in this respect:—

		Head and Body.	Tail.	Ear.	Hind-foot.
Specimen <i>a</i> , mature	♀	125	93	14	26
Specimen <i>b</i> , mature	♀	130	85	15·5	28
Specimen <i>c</i> , mature	♀	130	85	14	26
Specimen <i>d</i> , mature	♀	130	86	15	26
Specimen <i>e</i> , mature	♀	135	84	17	27
Specimen <i>f</i> , mature	♀	—	88	—	27
Specimen <i>g</i> , mature	♀	135	88	18 ?	26
Specimen <i>h</i> , small immature	♂	91	67	15	22·5
Specimen <i>i</i> , mature	♀	135	86	15	26
Specimen <i>k</i> , immature	♀	86	51	12	20·5
Specimen <i>l</i> , mature	♂	144	93	15	28
Specimen <i>m</i> , mature	♂	136	83	14	27
Specimen <i>n</i> , not quite mature	♀	128	89	14·5	27
Specimen <i>o</i> , not quite mature	♀	132	85	14·7	25
Specimen <i>p</i> , mature	♀	—	—	—	26·5
Specimen <i>q</i> , mature	♀	138	86	13·5	25
Specimen <i>r</i> , mature	♂	148	89	15·5	26
Specimen <i>s</i> , mature	♀	170	98	16	30·5
Specimen <i>t</i> , mature	♂	220	126	18	35
Specimen <i>u</i> , mature	♀	168	110	17	30·5

The width of the foot in specimen *d* is 7·2 mm., in specimen *t* is 10 mm., and in specimen *u* is 8 mm.

Two points will be noticed : first, that the males (which are much rarer than the females) are larger than the latter, and, secondly, that there are somewhat remarkable variations in the size of individual specimens.

The smallest mature male measures 136 mm. (head and body) in length, the largest 220 mm.

The smallest mature female measures 125 mm., the largest 170 mm. That the smaller one is mature is proved by the fact that it is actually carrying young attached to the teats.

Apart from size, and a curious point with regard to the number of mammae, the larger agree precisely with the smaller ones, and it may be noticed that the three large ones were secured in June, after six months of very good season, whilst the rest were all secured at earlier dates. Dependent as these Central Australian animals are to a large extent upon the nature of the season for their food, it is possible that they attain full size at very varying periods of life, and that an animal reared during a successive series of bad seasons, and consequent dearth of food, may never attain the full size characteristic of the species, though at the same time it may bear young ones.

A still more remarkable feature is to be noticed with regard to the number of mammae.

In ten specimens the number is six, in three eight are present, and in one only four.

In no case are there more than four to which, judging by their size, young ones have been attached ; in specimen *q*, with only four, these are all of large size, and have evidently recently had young attached.

In specimen *f* there are indications of two very small anterior mammae in addition to the usual six ; whilst in specimens *s* and *z* eight are present, all small in size, as the animals were captured some months after the breeding season.

Evidently the number of young produced at a birth is undergoing diminution, though whether this be a temporary or permanent reduction it is impossible to say. It is, however, worth noting that in both the large females caught after some months of exceptionally good season all eight mammae are equally developed. In two or three of those with only six, it is evidently the most anterior pair which have undergone retrogression. Possibly, as said above, two or three successive bad seasons, such as had actually occurred prior to the capture of the majority of the specimens, may have a very important direct influence upon the development of the body.

It is difficult, unless actually seen, to realise the different conditions of environment consequent in Central Australia upon good or bad seasons. In the latter all is dead, dry, and sterile, scarcely an insect, save ants, to be seen; in the former, everything is green and flourishing—flowers, insects, and animals of all kinds become abundant.

We know that in the case of crustacea, such as *Estheria* and *Apus*, and amongst the frogs, very rapid growth takes place, so that the animals are enabled to take advantage of a good season directly it comes. Possibly the same is true of the smaller mammals. They cannot aestivate like the frogs do, but in all likelihood they have the power of very rapid growth if conditions be favourable, when, and only when, they will reach their full state of development.

In addition to those of which the dimensions are given, I have, amongst others, four young ones, three females and one male. These were captured, together with females with young attached to the mamma, in November and December, which is evidently a breeding time. The four larger young ones belong to the previous breeding season, and cannot be many months old.

In no specimen, mature or immature, is there any trace of a lower p^4 . In the lower jaw there is a slight and in the upper (when p^4 is wanting) a larger diastema between p^3 and m^1 .

The only specimens in which the upper p^4 can be seen are (1) specimen *c*, in which it is present, very small and tubercular in shape, on the left side only; (2) specimen *h*, in which it can be just seen on each side; (3) specimen *k*, in which it is present on each side as a small tubercle; (4) specimen *l*, in which it is present in the same condition; (5) specimen *m*, in which it is very minute and pushed out to the side of the jaw.

In this species the lower p^4 has evidently been completely lost; there is no milk upper p^4 to be seen, and the permanent tooth is evidently gradually disappearing, the result being a close approximation, so far as numbers are concerned, to the dentition which is characteristic of the genus *Dasyurus*.

There is also considerable variation in the size of the hallux, which in specimen *p* is very small.

Note.—Since the above was written I have received additional specimens through the kindness of Messrs. Gillen and Byrne. *In each of four large females eight mammae are present, and young have evidently been attached to all of them.* In another somewhat smaller specimen seven mammae are present, four on the left

and three on the right side, and three embryos are attached on each side, the remaining mammae being small and evidently not recently used. In four smaller one six mammae are present, three on each side, and two embryos have been attached on each side. It is the anterior mammae which have disappeared.

(2) *Phascologale macdonnellensis*, Spencer.* The fat tailed Phascologale.

(Plate II., Figs. 1, 1a, 1b, 1c. Plate IV., Figs. 9, 10, 11, 12).

Size medium, the fur moderately coarse. The general colour of the back is dull greyish-brown, with a well-marked chestnut patch behind each ear. The ventral surface is grey. There is a light line above and below the eye. A light line runs along the upper jaw, and is continuous at the angle of the jaw with the white ventral surface of the head and lower jaw.

Ears rounded; clothed inside and out with short, light coloured hairs; reaching, when laid forward, to the middle or close to the anterior end of the eye. Hands and feet grey above.

Palms with six striated pads; the proximal half of the pollical pad curved, with the concavity facing inwards; the proximal outer pad V shaped, with the apex pointing towards the fingers, the inner leg of the V being very slightly longer than the outer.

There is a small tuft of white, whisker-like hairs placed on the posterior side of the fore arm, just above the wrist.

Soles naked except under the heel, where they are hairy; granulated; the hallucal pad divided into two; hallux reaching slightly further forward than the proximal end of the anterior pad of its side. Pads six in all and distinctly striated.

Tail shorter than head and body; notably stout for its proximal half; tapering rapidly at about the middle of its length, and from this gradually to the tip; markedly incrassate; covered with fairly long stiff hairs, but with no crest. In colour somewhat lighter than the body, the ventral being somewhat lighter than the dorsal surface.

Pouch only slightly developed, opening vertically downwards. Two lateral folds of skin; within the pouch area the hairs are comparatively scanty and light coloured throughout; external to the pouch area the hairs are dark coloured for their basal two-thirds, the pouch area being thus clearly marked out, and the folds being doubtless more developed when young are present.

* Proceedings Royal Society Victoria.

Mammæ six ; three on each side.

Fur composed of larger coarse hairs ; the lower half slate-grey, the upper half dark brown and projecting beyond the under-fur.

Under-fur composed of finer hairs, slate-grey in their lower half, merging into lighter grey and then light brown at the extremity.

On the tail all the hairs are stiff, the majority being light brown ; a smaller number scattered about are dark brown at the base, succeeded by a lighter band and then by a dark tip.

Under the jaw the hairs are white, with a dark brown basal portion ; the hairs not being very close together, the dark bases show clearly. On and behind the pectoral region ventrally the hairs (under-fur) are close together ; all are slate-grey in the proximal and white in the distal half, giving a general grey appearance, which merges into brown at the sides of the body.

DIMENSIONS.

—	(a)	(b)	(c)	(d)	(e)
	Adult ♀ in al.	Adult ♂ in al.	Adult ♂ in al.	Adult ♂ in al.	Adult ♀ in al.
Head and Body - - -	92	102	120	104	96
Tail - - - -	77	70	74	72	71
Hind-foot, length - -	14	14	15	15	14
„ „ greatest width -	4	4.2	5	4	5.2
Ear - - - -	13	13	12.5	12	11.2

Dentition *i.* $\frac{1.2.3.4}{1.2.3}$ *c.* 1 *p.m.* $\frac{1.0.3.4}{1.0.3.4}$ *m.* $\frac{1.2.3.4}{1.2.3.4}$

In the upper jaw p^4 is either absent or very minute in each of thirteen specimens examined ; in the lower jaw it is apparently almost always absent. In only one specimen (*d*) is it present, and here it is very minute, and only visible on the right side. It is evidently almost entirely lost, but its presence in this one instance will serve to show the danger of regarding its total absence as determined in a given species until a fair number of specimens have been examined. It is of course possible that it may be yet found in *Phascogale cristicauda* and

Dasyuroides byrnei, but no trace has been found in the numerous specimens yet examined.

Skull somewhat delicately built. Flattened and broadened anteriorly, with the muzzle rather short and conical, as in *P/h. minutissima*. Nasals comparatively little expanded posteriorly. Occipital ridges well developed. A central depression in the region of the posterior ends of the nasals and anterior ends of the frontals. Anterior palatine foramen just reaching to the level of the canines. A pair of large vacuities opposite to the first three molars. Bullae large and swollen; their mastoid portions much enlarged.

SKULL DIMENSIONS (♀).

Basal length	25
Nasals, length	10
„ greatest width	3
„ least width	2
Intertemporal breadth	5.2
Palate, length	14
„ breadth between outer corners of m^3	9.5
Palatal foramen	2
Basi cranial axis	9
„ facial „	16
Facial index	177.7
Teeth, horizontal length of p^4	minute
„ „ „ m^1-m^3	6
„ breadth m^4	1.7

Habitat.—Central Australia, Alice Springs. The animal is terrestrial, living in holes amongst rocks and under stones.

The first specimen was secured by Mounted-trooper South, of Alice Springs, and by him presented to Dr. Stirling, for whom it had been intended. Dr. Stirling kindly handed it over to me for description, as officer in charge of the zoological department of the expedition.

Subsequently, whilst staying at the Alice Springs, I was able, through the kindness of Mr. F. J. Gillen, to secure two more specimens, both of them females.

The animal is evidently in the main terrestrial, being captured by the blacks (two specimens also were caught by cats) in holes amongst stones.

Since the first description was written, and in consequence of an exceptionally good season in Central Australia, ten more have been captured, for which I am indebted to Mr. F. J. Gillen and to Mr. J. Field.

Though I have received a large collection of marsupials from Charlotte Waters, yet this species is not included, the reason apparently being that it lives, as Mr. Field informs me, under the large rocks on hill-sides, and is therefore confined to the hill range country further to the north, where, again, species such as *Phascologale cristicauda*, which is frequently found burrowing in the stony plains around Charlotte Waters, does not seem to occur.

The native name is Enoonta Latwinna.

(3) *Phascologale calura*, Gould. The lesser brush-tailed pouched mouse.

This is evidently not a common form in the central district. I am much indebted to Mr. F. J. Gillen for an adult male specimen captured at Alice Springs.

DIMENSIONS, ADULT ♂ (in al.)

Head and body	...	...	...	135 mm.
Tail	...	...	...	147 „
Hind-foot, length	...	...	...	24 „
„ greatest width	...	...	...	7 „
Ear	...	...	...	23 „

Habitat.—South, West, and Central Australia.

(4) *Sminthopsis crassicaudata*, Gould. The fat-tailed pouched mouse.

This is evidently the commonest species of *Sminthopsis* in the central district.

It is a burrowing (?), nocturnal animal, and hence, like most of the smaller marsupials, not easy to catch. In all the specimens in my collection the fur is soft and fine and the general body colour dark grey. On the palm are four granulated elevations at the base of the fingers, on which one of the granulations is larger than the others. On the pollical side is a V-shaped pad, in which, at the hinder end of the inner and longer arm of the V, the granulations may not have completely fused; at the level of the apex of the V, and on the opposite side of the palm, is a small round pad.

The sole has three pads at the base of the toes, without distinctly-striated pads.

The ears, when laid forward, reach (in spirit specimens) at least half way between the anterior end of the eye and the tip of the snout.

The tail varies in length, but is relatively longer than the specimen of which measurements are given in the British Museum Catalogue and than that of mature specimens from the coastal district. It is incrassated and light grey in colour all over, the ventral being little, if any, lighter in colour than the dorsal surface.

The following are the dimensions of eight of the specimens :

	Specimen <i>a</i> ♀ in al.	Specimen <i>b</i> ♀ in al.	Specimen <i>c</i> ♀ in al.	Specimen <i>d</i> ♀ in al.	Specimen <i>e</i> Immature ♀ in al.	Specimen <i>f</i> ♀ in al.	Specimen <i>g</i> ♂ in al.	Specimen <i>h</i> ♀ in al.
Head and Body -	84	80	85	89	68	91	82	96
Tail -	71.5	73	69	56*	56	73	75	52
Hind-foot -	15.5	15.5	16	15.5	15	15	15.5	15
Ear -	14.5	17	16	15.5	14	19	17	15

* Tip broken off.

In specimen *a* ten mammae are present, to four of which young ones are attached.

In specimen *b* ten mammae are present, to five of which embryos are attached.

In specimen *c* ten mammae are present.

In specimen *d* only six mammae can be seen, though the animal is mature; these correspond to the anterior three of each side present in the other specimens. Except in regard to this point the specimen is closely similar to the others, and evidently belongs to the same species. It was captured at Charlotte Waters on the same sandy plains in which specimens *a*, *b*, and *c* were caught.

In specimen *f* ten mammae are present, two on one side and four on the other, having embryos attached. Specimens with embryos attached to the teats were captured in November and December, which are evidently breeding months. Specimen *h** did not come from Central Australia, and its measurements are inserted for comparison with those from the latter district. It will be seen that the tail is proportionately shorter. With the exception of this example, all the

* From the southern part of South Australia. I am indebted for this to Mr. A. Zietz.

above (and also other specimens from Central Australia of which measurements have been made), whilst they agree generally in length of the body with the measurements given in the British Museum Catalogue, vary from these in the uniformly greater length of tail, and the slightly greater length of the hind-foot. In the greatest width of the latter (across the region of the pads at the base of the toes) they are all closely similar, varying only between 2·7 and slightly more than 3 mm. The head is proportionately narrower and longer in all of them than in specimen *h*. There can however be little doubt but that they are all referable to the species *crassicaudata*, and that the greater length of tail, which, however, never exceeds that of the body, and the greater length of the head indicate merely a local variation.

In all specimens there are present a few long whisker-like hairs just above the wrist which point outwards and backwards, and the longest of which measures 12 mm.

Note.—A specimen received in August has ten young ones attached to the teats. These had evidently been produced in July after the occurrence of an exceptionally good season. Under favourable circumstances there are evidently therefore at least two breeding seasons in Central Australia. Females with young attached were secured in November and December, and again after the lapse of six months (during which period, though many were captured, none had young) in July. It may also be noticed that the full number of young were only observed at the close of an exceptionally good season.

(5) *Sminthopsis murina*, Waterhouse. Common pouched mouse.

This species does not appear to be common in the central district, for, although a large number of the closely-allied *S. crassicaudata* have been secured, only two specimens of it were obtained, one at Alice Springs and one at Oodnadatta. Mr. Byrne, who, as will be seen from this report, has collected a very large number of marsupials, and is thoroughly well acquainted with those existing in the Charlotte Waters district, has not as yet met with this species.

The foot is proportionately broader than in *S. crassicaudata*, and the tail is longer than the head and body, and is not incrassated.

The face, as described in *S. murina*, has a darker mark in front of and around the eyes, but the same is also present in all the specimens of *S. crassicaudata*, the colouration of the two species, so far as the Central Australian specimens are concerned, agreeing very closely.

The upper p^4 is notably larger than either p^3 or p^1 .

Sminthopsis murina, var. *constricta*.

At Oodnadatta a specimen was secured—unfortunately only a single one—which in certain respects may be considered as intermediate between *S. murina* and *S. crassicaudata*. The head is shorter and broader than in the specimens of the latter and the tail longer. On the other hand, it is distinctly incrassated, though not so markedly so or so stout as in *S. crassicaudata*.

The foot is proportionately broader than in the latter, measuring 4 mm. across the region of the sole pads, which are fairly well developed, but not striated.

The general colouration is closely similar to that of *S. murina*.

The ears, when laid forward, reach to the anterior canthus of the eye.

There is a small tuft of white, whisker-like hairs on the posterior face of the fore arm just above the wrist.

It may perhaps, on the whole, be best regarded as a variety of *S. murina*.

DIMENSIONS OF ♀ (in al.)

Head and body	...	...	...	...	71
Tail	...	...	...	...	80
Hind-foot	...	...	...	...	15.5
Greatest width of hind-foot	...	...	...	...	4
Ear	...	...	...	...	12.5

(6) *Sminthopsis larapinta*, Spencer.*

(Plate II., Figs. 2, 2a, 2b).

Size small, form light and delicate. Fur very soft and fine, moderately long, composed almost entirely of under-fur with few longer dark hairs.

General colour a mouse-grey, suffused on the dorsal surface with rufous. The sides, under surface of the body and head, and upper surfaces of the hands and feet are white.

Ears large; when laid forward they reach considerably beyond the eye.

Palms naked, granulated. The posterior external pad is V-shaped, with the apex pointing forwards, and is striated.

A small tuft of white, whisker-like hairs is present on the posterior side of of the fore-limb, just above the wrist.

* Proc. R.S. Viet., vol. viii. (New Series), p. 8.

Soles granulated anteriorly and in the median part. Four pads present, a small one at the base of the hallux and three larger ones at the base of the toes. The latter are faintly striated.

Tail much longer than body. Very stout in its proximal part and strongly incrassated; very much stouter and more strongly incrassated than in *S. crassicaudata*. Tapering to a long thin end. Strongly scaled, with at the proximal end short hairs, which do not hide the scales. Distally the hairs are more numerous and somewhat longer towards the tip.

Dentition *i.* $\frac{1.2.3.4}{1.2.3.}$ *c.* $\frac{1}{1}$ *p.m.* $\frac{1.0.3.4}{1.0.3.4}$ *m.* $\frac{1.2.3.4}{1.2.3.4}$

Teeth as usual in the genus. Canines small, and the upper premolars increasing in size backwards.

DIMENSIONS.

			Specimen <i>a.</i> Adult ♂ in al.	Specimen <i>b.</i> Adult ♂ in al.	Specimen <i>c.</i> Adult ♂ in al.
Head and Body	-	-	88	85	95
Tail	-	-	105	95	111
Hind-foot	-	-	18.2	17.5	18
Ear	-	-	14	15	16
Width of Hind-foot	-	-	4	3.5	4

Habitat.—Central Australia, Charlotte Waters. Terrestrial; burrowing. Mr. Byrne informs me that this species seems to prefer the stony table-lands, whilst *S. crassicaudata* prefers the softer ground near the creeks and amongst the sand-hills.

The characteristic features of this form are (1) the remarkably long, stout and strongly-incrassated tail, and (2) the relative length and width of the hind-foot.

There is no difficulty in distinguishing the animal from *S. crassicaudata*, which is frequently found in the same district. I have some thirty mature specimens of the latter, which all agree closely with one another in the relative dimensions of the body, and in none of which the tail is as long as the head and body, nor is there any approach to the great widening-out of the proximal portion which forms

such a prominent feature in *S. larapinta*. The greater proportionate length of the foot seems to distinguish it also from both *S. murina* and *S. crassicaudata*.

The general dimensions of the body are more similar to those of *S. leucopus*, but the sole pads are not so markedly striated, and the great swollen tail serves at once to distinguish it from this species.

The specific name is adapted from the native name of the Finke River—the Larapinta—in which district it is found, and for the specimens upon which the species is founded I am indebted to the kindness of Mr. P. M. Byrne.

(7) *Sminthopsis psammophilus*, Spencer.* The sand-hill pouched mouse.

(Plate I., Figs. 2, 2a, 2b.)

Size medium. Fur close, long and fine. Dorsal surface dark grey. Ventral surface of head and body white. A brownish tinge on the thighs. The hairs on the back are of a grey colour basally and darker at their tips. Amongst the long, fine hairs are interspersed on the back long, stiff, darker hairs. On the under surface of the body the hairs are grey in their basal halves and white in their outer halves. On the thigh the white may be replaced by a brown tinge.

The ears are covered back and front with short, stiff, grey hairs.

There is a line of white hairs round the eye.

A small tuft of long, white, bristle-like hairs is placed on the fore-arm just above the wrist.

The hairs of the hands and feet are cream-coloured.

The hairs on the soles reach to the pads, except over a narrow median granulated space stretching backwards from the base of the toes to the hallux.

The tail is covered with short, stiff, whitish hairs dorsally and laterally, and with a well-marked line of black hairs ventrally. The hairs increase slightly in length on the upper and lower surface at the tip, so as to form a slight crest.

The palms are granulated, with six ill-defined elevations, but no striated pads.

The soles are hairy; three pads are present at the base of the toes placed on granulated elevations, but are not striated. The hallux is small, and lies about half-way between the heel and the base of the claws.

The ears are large, reaching half-way between the eye and the tip of the snout.

* Proc. R.S. Vict., vol. vii. (New Series), 1895, p. 222.

The tail is long and thin.

Mammæ and pouch ? (Only a single male specimen was secured).

DIMENSIONS OF MALE (in al.).

Head and body	...	...	..	105
Tail ...	...	...	...	116
(Very tip broken off).				
Ear ...	...	...	...	24.5
Hind-foot	...	...	...	25

Dentition *i.* 1.2.3.4 *c.* 1 *p.m.* 1.0.3.4 *m.* 1.2.3.4
 1.2.3. 1 1.0.3.4 1.2.3.4

Habitat.—Central Australia, near Lake Amadeus. Terrestrial, living amongst sand-hills covered with tussocks of porcupine grass (*Triodia irritans*).

Our attention was drawn to the first specimen seen by Mr. E. C. Cowle as we were riding over porcupine sand-hills. It was running about in the daytime from tussock to tussock of grass. A second specimen was seen in the same district, but not captured, and Mr. Cowle has since informed me that he has seen the same animal in the James Range.

Though we only secured the single specimen, there can be no doubt of its specific distinction from other species of the genus.

(8) *Dasyuroides byrnei*, Spencer.* Byrne's pouched mouse.

(Plate III. Plate IV., Figs. 1, 2, 3, 4).

The following is a more complete description of this species, of which the preliminary notice has already appeared.

Size similar to that of the larger species of *Phascologale*. Form stout and strong. Fur close and soft, mainly composed of the under-fur. General colour a grizzled grey with a faint rufous tinge, especially on the head and back.

Chin, ventral surface, inner sides of limbs and upper surfaces of hands and feet white.

Tail rufous-coloured on rather less than its proximal half, where it is thickly covered with fairly-long hair. The distal half is thickly covered all round with long black hairs, which form a very well-marked dorsal and ventral crest.

* Proc. Royal Soc., vol. viii. (New Series), p. 6.

A small tuft of five or six long white and backwardly-directed, bristle-like hairs is placed on the fore-arm, just above and behind the wrist. One or two of them are longer than the rest (the longest measures 42 mm.), and resemble the face whiskers.

Ears naked above. Laid forward, they reach nearly to the anterior canthus of the eye.

Palms with five well-marked and faintly-striated pads placed on granular elevations.

Hallux absent.

Soles comparatively narrow, with three well-marked pads placed on elevations at the base of the toes; the pads with fairly well-marked striations. The median part of the sole is naked and granulated. Each side has a strongly-marked, close-set series of hairs bending over towards the mid line.

Tail fairly thick, but not incrassated.

Mammæ six. Pouch very slightly developed, with two low lateral folds.

Skull somewhat strongly built. Muzzle short and broad. Greatest breadth of nasals slightly less than once and a half their least breadth.

Inter-orbital space fairly broad, its edges slightly converging backwards, and not forming rudimentary post-orbital processes.

A median depression is present in the region of the posterior part of the nasals and the anterior part of the frontals. Occipital ridges well developed.

Anterior palatine foramen reaching just beyond the level of the front edge of the canines. A pair of large vacuities reaching from the middle of m^1 to the level of m^1 ; a smaller pair of vacuities behind these.

Bullæ very large and rounded; their mastoid portion much inflated.

The following are the skull dimensions:—

Basal length	...	...	...	37·2
Greatest breadth	...	...	..	24·2
Nasals, length...	...	.	...	13·5
„ greatest breadth	...	...	...	4·2
„ least	„	...	..	3
Inter-temporal breadth	...	...	...	8

Palate, length ...	...	...	...	21
„ breadth between outer corners of m^3 ...				12
Basi-cranial axis ...	...	...	...	9.15
Basi-facial axis ...	...	...	...	23
Facial index ...	...	...	...	153.3
Teeth, horizontal length p^4 ...		...	...	1.2
„ length of ms^{1-3} ...	...	...	...	9
„ breadth of m^4 ...	...	...	...	3

Dentition i .	1.2.3.4	c .	1	$p.m.$	1.0.3.4	m .	1.2.3.4
	1.2.3		1		1.0.3.0		1.2.3.4

The dentition is somewhat similar to that of such a Phascologale as *Ph. apicalis*.

There is a considerable interval in the upper jaw between i^1 and i^2 . The canines are large and strong, that in the upper jaw measuring from 3 to 4 mm. in length, and that in the lower jaw upwards of 3 mm. In the immature form the upper p^1 is absent; in somewhat older specimens it is present and about the same size as p^1 , both of them being smaller than p^3 . The lower p^1 is never present (in seven specimens examined). Presumably there is no milk upper p^4 .

DIMENSIONS.

	a Mature ♂ in al.	b Mature ♀ in al.	c Mature ♂ in al.	d Immature ♂ in al.	e Mature ♂ in al.	f Mature ♂ in al.	g Mature ♂ in al.
Head and Body	182	175	165	125	175	170	166
Tail	130	132	140	100	138	134	131
Ear	18	20	20	16.5	21	23	21
Hind-foot	38	37	39	33	37	37	38

The greatest width of the hind-foot varies between 7.5 and 9 mm.

In general appearance, except in regard to the tail, *Dasyuroides byrnei* presents a strong resemblance to large specimens of *Ph. cristicauda*, but can at once be distinguished by the absence of a hallux. In addition, it is of somewhat larger size and stouter build. Both species have the strongly black-crested tail, rufous-

coloured in its proximal half; but it is not so stout in *D. byrnei* as in *Ph. cristicauda*, nor is it incrassated.

Habitat.—Central Australia. Terrestrial; burrowing; insectivorous. Living in burrows on sandy and stony table-lands. Nocturnal.

My specimens were secured at Charlotte Waters, and I am indebted for them to the kindness of my friend Mr. P. M. Byrne, whose name I have much pleasure in associating with the species. Whilst collecting at Charlotte Waters in February, 1895, I had the opportunity of seeing both *Dasyuroides byrnei* and *Phascologale cristicauda* alive. The superficial resemblance of the two is remarkable, and so striking that even the blackfellows insisted upon the male of the former being that of the latter species, which is rarely found. It was a curious fact that the females of the first and the males of the second were very rare.

As at present defined, this species cannot be placed in either of the genera *Sminthopsis* or *Phascologale*. In certain respects it presents characters at present regarded as distinctive of one or the other, while it differs markedly from both of them in the absence of a hallux. To have associated it with these forms would have meant the merging of the two genera into one another, and the additional widening of the characters so as to include a non-hallucated form. The only other alternative was the creation of a new genus, and I therefore adopted this plan, though it may be pointed out that the genera *Phascologale* and *Sminthopsis* stand in need of revision.

Dasyuroides may be regarded as a genus closely allied to both *Phascologale* and *Sminthopsis*, and serving at the same time as an approach to *Dasyurus*. These relationships are indicated in the following points:—

The general form of the body closely resembles that of the larger *Phascologales* or of a very small *Dasyurus*, and is very different from, that is, much less slender than that of even the largest *Sminthopsis* (*S. virginie*).

The shape of the hind feet is neither that of a *Phascologale* nor of a *Sminthopsis*. Judging merely by the length, the only dimension given in description, it might naturally be supposed that the foot was more or less similar in its proportions to such a form as *Ph. wallacei*, for example. This, however, is far from being the case, as, though the two animals agree in length of body and foot, yet the latter in *D. byrnei* is very much narrower than that of *Ph. wallacei*, and when placed side by side* they are seen to belong to two entirely different types of

* That is, comparing the foot of *D. byrnei* with that of *Ph. wallacei* represented in pl. xxiii. of the Brit. Mus. Cat. of Marsupials and Monotremes, 1888.

feet. On the other hand, while the foot is more similar to that of a *Sminthopsis*, it differs from this in being more stoutly built; whilst, in the absence of hallux, it is markedly distinguished from that of either genus.

The claws are strong, and curved as in *Phascologale*.

The sole of the foot is hairy—more so, indeed, than in many species of *Sminthopsis*.

The pouch is very slightly developed as in *Phascologale*, and the mammae are six in number, and not eight or ten as is usual in *Sminthopsis*.

The skull is flattened in the frontal region as in *Phascologale*; but, on the other hand, it differs from the latter and agrees with *Sminthopsis* in the important character of the nasal bones, which are only very slightly expanded posteriorly.

The dentition, on the contrary, is closely similar to that of a *Phascologale* such as *Ph. apicalis*, in which p^4 in each jaw is disappearing; while in *D. byrnei* it appears to have been lost altogether in the lower jaw. In this respect the latter shows an approach to *Dasyurus*, though not to the same extent as is done by *Ph. cristicauda*.

On the whole, perhaps, in spite of the marked difference in the shape and proportions of the foot, the affinity of *Dasyuroides* is closer with the genus *Phascologale* than with *Sminthopsis*.

(9) *Antechinomys laniger*, Gould. The jerboa pouched mouse.

Of this rare species we only secured two specimens, captured along with several examples of the very common jerboa-rat (*Hapalotis mitchelli*) on the Missionary Plains in the Finke Valley, between the James Range to the south and the McDonnell Ranges to the north. As other writers have before noticed, the figures given by Gould (under the name of *Phascologale lanigera*), are very misleading, both as to form, colour and habitat.

The most striking features of the animal are its slender graceful form and its disproportionately long and thin hind legs. It is purely terrestrial, living in burrows in the sandy plain districts along with countless numbers of *Hapalotis* and a small species of *Mus*.

In general appearance it bears a striking resemblance, both in colour and the form of its body, to *Hapalotis mitchelli*, but is more slender in build.

The two specimens (both males) collected by us are somewhat darker in colour than the one figured by Mr. Alston.*

In addition to the characters usually given it may be noted that along the anterior edge of the ears runs a strongly-marked fringe of long white hairs, 5 mm. in length.

In his work on "Marsupials and Monotremes,"† Mr. Lydekker says, referring to a remark made by Mr. Thomas dealing with the method of progression of *Antechinomys*, "this saltatory mode of progression having been doubtless developed in accordance with the exigencies of the arid sandy country inhabited alike by *Antechinomys* and *Hapalotis*."

Watching the animals in their natural surroundings, it is really somewhat difficult to see what is exactly the advantage gained by such small forms of animals in this saltatory mode of progression. The country in which they usually live is covered with big tussocks of grass and shrubs of various sizes. With a larger animal, such as a kangaroo, it is doubtless an advantage to be able to go straight ahead instead of having to "dodge round" tussocks of grass; but neither the *Hapalotis* nor the *Antechinomys* gain any such advantage, as both are far too small to spring over the grass tussocks, and perhaps the most noticeable point in connection with this matter is that the true mouse, which lives in great numbers in the same part and has not taken on this saltatory method, thrives just as well.

What the small animals, whose chief enemies are birds of prey, appear to need is the power of rapidly gaining the shelter of a shrub or tussock of grass, and there lie so close to one another, that a running animal such as a true mouse can do this as rapidly as a jumping animal such as a *Hapalotis* can, possibly even a little more rapidly, as the run into shelter is a continuous one, whereas, when the *Hapalotis* or *Antechinomys* has taken a jump bringing it close to shelter, there must be a slight pause prior to the final run. A very slight difference in time when a hawk is in pursuit will save or lose the animal its life. Possibly the real advantage in the saltatory method of progression amongst these small forms lies in the greater difficulty of pouncing down upon an animal travelling by leaps and bounds rather than in any advantage gained in the way of speed. So far as travelling over the ground is concerned, a mouse can and does do it just as well as a *Hapalotis*.

It is somewhat curious to notice that two animals so differently organised as *Hapalotis* and *Antechinomys* have taken on the same habit and live side by side, one in large numbers and the other very scarce.

* P.Z.S., 1880.

† Allen's Naturalist's Library, "Marsupials and Monotremes," p. 181.

Since the return of the expedition I have been able, through the kindness of Mr. Byrne, to secure three more specimens, two of them fortunately being females.

The measurements of the five specimens in my possession are as follows:—

	Specimen <i>a</i> .	Specimen <i>b</i> .	Specimen <i>c</i> .	Specimen <i>d</i> .	Specimen <i>e</i> .
	Adult ♂ in al.	Adult ♂ in al.	Adult ♂ in al.	Adult ♀ in al.	Adult ♀ in al.
Head and Body - - -	87	82	95	100	95
Tail - - - -	129	116	138	136	136
Ear - - - -	23	22	19	21	20
Hind-foot - - -	28·5	29	33	32	31
Muzzle to Eye - - -	15	14	17	16	15
Forearm and Hand - -	33·5	34	36	35·5	34
Heel to front of large sole pad	24	25	28·2	28	26
Lower Leg - - - -	34	34	38	37	37

Messrs. Thomas,* Lydekker,† and Ogilby† state that the number of teats is unknown. Krefft§ says:—"The female has no pouch, and is provided with eight mammae." In both of specimens *d* and *e*, of which the dimensions are given above, there are six mammae arranged in a circle. There is no trace of a pouch, no folds of any kind being distinguishable, and the whole of the mammary area is thickly covered with hairs. Judging from the dimensions the animals are mature, so that probably the teats are only largely developed during the breeding season.

It does not, however, follow that because the number of teats in the two females above described is six, that therefore Mr. Krefft was wrong in stating that eight are present, as, judging from the variability previously described in the cases of *Phas. cristicauda* and *S. crassicaudata*, the number of teats is evidently subject to variation within the limits of a species.

* British Museum Catalogue p. 310.

† Catalogue of Australian Mammals, p. 9.

‡ "Marsupials and Monotremes," p. 181.

§ "Mammals of Australia."

Family NOTORYCTIDÆ.

(1) *Notoryctes typhlops*, Stirling.

This animal is still very rare and difficult to procure, owing to its habits. The blacks say that they can only find it after rain, when the sand is firm enough to allow of its tracks being followed.

Its distribution, so far as is at present known, extends as far south as Charlotte Waters; in all probability it will be found in the sand-hill country over the whole central district and in the similar country in West Australia.

It is probably the single representative of the only family of marsupials confined exclusively to the Eremian region.

A living specimen (which unfortunately died soon after), was, through the kindness of Mr. Ross, secured at Crown Point, on the Finke River. I was not with the party when the animal was brought in, but Dr. Stirling has kindly furnished me with the following notes:—

“The animal was let loose in the sand in the garden. It travelled over the surface pretty quickly, and with a lateral undulatory movement of the body, which was at the same time appressed to the ground. It tried repeatedly to burrow, but was soon stopped by the hard earth which lay beneath the two or three inches of loose surface sand. Eventually it began to make its way into the hard substratum. In burrowing it seems to use its snout to assist in boring its way, and the claws of the fore-paws were used as much for cutting as for scooping; the edge of the large triangular nail of the fifth digit being an efficient instrument for this purpose. The fore-paws work under the body and do not throw the sand outwards. The hind-paws come into play as soon as it gets its body well under the surface, and are used to push back the sand.

“The track when moving on the surface is peculiar and unmistakable, the tail, being closely appressed to the ground and seeming to form a sort of fulcrum or *point d'appui*, leaves a zig-zag, continuous trail, and on each side of that is a more or less interrupted and confused track made of the paws, which are never lifted but dragged along. The belly also remains in contact with the surface.

“When taken in the hollow of the hand it made no attempt to bite, but worked away with its snout and paws in its unavailing attempts to burrow through the fingers.

“There had been no rain when this animal was caught. It was put into a box of sand, which was wrapped up and kept in a warm place by the fire (weather cold, but not excessively so).

“Next morning the ‘mole’ was evidently *in extremis*, and it died during the forenoon.

“The fur had a singularly soft silky feel and was distinctly iridescent.”

Mr. Byrne, writing to me in September, 1895, says:—“A few days ago I had a *Notoryctes* alive for about twenty-four hours, but he was very weak when brought in and seemed unable to burrow to any depth in the tub of sand into which I put him. He eat one “witchetty,” and once or twice, when everything was quiet, he elevated his head and tail quietly and made a slight chirping noise, which he repeated two or three times, running forward a few steps between each cry. I fancy that fear has a good deal to do with their dying so quickly in captivity, as they are very nervous little animals, and the slightest sound disturbs them and starts them burrowing. When held in the hand they scratch incessantly.”

I have now had more than forty specimens* in my possession, and add here a few notes with regard to certain points. Since Dr. Stirling’s original account was published, further notes have been issued by the latter, and Dr. Gadow has dealt with certain points, such as the teeth, and Professor Wilson has published the first instalment of his detailed account of the musculature. Dr. Stirling and myself are now engaged upon an investigation of certain parts, such as the teeth, fur, and reproductive organs.

Dimensions of the body.—There is comparatively little variation in this respect, and one sex is not decidedly larger than the other, though the longest specimen yet actually measured is a male. The following table relates to twenty of those now in my possession:—

	1	2	3	4	5	6	7	8	9	10
	♀	♀	♀	♂	♂	♂	♂	♂	♀	♂
Length from snout to tip of tail - -	155	155	160	152	151	148	148	158	157	155
Length from anus to tip of tail - -	23·5	21·5	23	24	24	21	22	24	23	24

* To Mr. Byrne I am much indebted for a large number of specimens. The present season appears to have been an exceptionally favourable one for securing this still rare form of marsupial.

	11	12	13	14	15	16	17	18	19	20
	♀	♂	♂	♂	♀	♂	♀	♀	♀	♂
Length from snout to tip of tail - -	145	145	143	155	155	180	152	152	148	170
Length from anus to tip of tail - -	22	24	22	24	22	21	25	23	23.5	26

As Dr. Stirling stated, there is no trace of an external scrotum. Mr. Benham, in notes furnished to Dr. Stirling, said that "the testes of a male are like those of a cat," but in none of the numerous male specimens which we have now examined can any external trace of the testes be detected. The only possible explanation of Mr. Benham's note is that they may be more distinguishable externally just at the breeding season.

Colour.—The colour varies considerably from a light almost silvery tint to a rich chestnut-brown, and an iridescent effect is often noticeable, especially in the live animal.

Fur.—This is long, soft and silky, and consists of (1) very fine hairs equivalent to the under-fur of other marsupials, and (2) much fewer, larger and somewhat flattened hairs.

The fine hairs may be perfectly smooth and thread-like, or, not infrequently, they may have serrated edges. The large hairs are of no greater length than the fine ones, and their presence is not noticed, except the fur be examined with a lens, when they can be distinguished by their usually somewhat darker colour and coarser appearance. Each has a long shaft which swells out into a flattened more expanded portion, and then this suddenly contracts to form a very short pointed free end. The broad flattened out part occupies perhaps half the length of the hair.

The most interesting point, however, is concerned with their arrangement. Sections through the skin at once show that a bunch of fine hairs perhaps, as many as twenty in number, issues from a common follicular opening on the surface, and that to each group of fine hairs corresponds a single large flattened one which passes out through the same opening, and is always placed behind the small hairs.

It is especially interesting to notice this in connection with the descriptions given by Leydig, Poulton and others of the arrangement of the hairs in

Ornithorhynchus, where, from a common follicular opening, issue four bundles of small hairs behind the single large one.

In the first specimen which came into my hands some years ago I was struck with the appearance of a patch of hairs just above the sacral region. They were somewhat darker than the rest and more closely matted together, and conveyed the impression that they might be associated with the presence of a glandular area. Every specimen since examined has shown exactly the same appearance, and sections through this region show that a curious modification of the hairs is present. The groups of follicles run down to a much greater depth than elsewhere, so that in either transverse or longitudinal section the appearance is presented of a pad-like structure about 10 mm. in diameter, which gradually thins off at each side. This pad is made up of the long and very closely-set groups of hair follicles, each group consisting of a large number of fine and a single large flattened hair.

Examination of the hairs shows that the larger ones are somewhat shorter in this part than the fine ones, and that their ends are always broken up into from two to six very slightly divergent stiff, pointed branches. These, as it were, entangle the fine hairs, and so produce the matted appearance.

This modified area is more prominent in dried than spirit specimens, looking in the former like a rather dirty patch where the fur has been pressed down. It is difficult to attach any meaning to its presence, but its constant development would seem to indicate that it must serve some special purpose.

Teeth. In his paper "On the Systematic Position of *Notoryctes typhlops*"* Dr. Gadow, from the examination of nine specimens, said:—"The full number of teeth seems to be 'i. $\frac{3}{3}$, c. $\frac{1}{1}$, p.m. $\frac{2}{2}$, m. $\frac{4}{4}$.'" The full number of teeth in each jaw according to this being ten.

There is, as Dr. Stirling and Dr. Gadow have pointed out, considerable variation in the number of teeth in front of the molars, which appear to be always four in number in both the upper and lower jaws.

As this question will be more fully dealt with by Dr. Stirling and myself, I will only say here that the full number of teeth in each jaw is eleven, but that in none of the thirty specimens which I have so far examined has there ever been the full number present in both jaws.

* Proc. Zool. Soc. London, May 3, 1892, p. 361.

It was only after examining twenty-nine specimens that one was found in which the full number of incisors was present in the upper jaw, whilst in only a comparatively few specimens an additional premolar was present in the lower jaw, always small and pushed out to the side of the jaw, in front of the first molar.

The full dentition so far as at present known is $i. \begin{smallmatrix} 4 \\ 3 \end{smallmatrix} c. \begin{smallmatrix} 1 \\ 1 \end{smallmatrix} p.m. \begin{smallmatrix} 2 \\ 3 \end{smallmatrix} m. \begin{smallmatrix} 4 \\ 4 \end{smallmatrix}$.

In the specimens in which it is present the upper p^1 is implanted immediately in front of the premaxillary suture, and the presence of this tooth serves to eliminate one of the features in which, as recorded by Dr. Gadow (and so far as the material available up to that time existed), *Notoryctes* might be regarded as differing from recent marsupials.

Dr. Gadow remarks that "the most remarkable feature is, however, that the reduction either in numbers above or in size, or in both, is undoubtedly greater in the left mandible than in the right. This fact seems well established, considering that out of the nine specimens examined the left sided reduction is greater in not less than eight specimens; reduction in size alone in three, in numbers in five specimens. The total number of teeth in the nine right mandibles is eighty-six, in the corresponding left mandibles only seventy-nine. The number of reduced and of absent teeth on the right side is eleven, on the left side nineteen. Such a decided asymmetry is practically unique. I have failed to perceive any corresponding asymmetry in the size of the two mandibles."

I have carefully examined the teeth of a large number of specimens, and give the rough results, so far as numbers are concerned, which are derived from twenty-five of them :—

LEFT UPPER JAW.

Three specimens with 8 teeth each	...	...	24
Six specimens with 9 teeth each	...	...	54
Fifteen specimens with 10 teeth each	...	...	150
One specimen with 11 teeth	...	...	11
Total	...	...	239

RIGHT UPPER JAW.

One specimen with 7 teeth	...	...	7
One specimen with 8 teeth	...	...	8
Eight specimens with 9 teeth each	...	...	72
Fifteen specimens with 10 teeth each	...	...	150
Total	...	...	237

LEFT LOWER JAW.

One specimen with 7 teeth	7
Five specimens with 8 teeth each	40
Nine specimens with 9 teeth each	81
Nine specimens with 10 teeth each	90
One specimen with 11 teeth	11
<hr/>	
Total	229

RIGHT LOWER JAW.

One specimen with 5 teeth	5
Six specimens with 8 teeth	48
Eight specimens with 9 teeth	72
Nine specimens with 10 teeth	90
One specimen with 11 teeth	11
<hr/>	
Total	226

If we take into account the fact that one specimen included in the above is very old, and that on one side of the lower jaw all the teeth have dropped out in front of the large premolar, whilst two remain on the other side, it will be seen that there is scarcely any discrepancy between the numbers of teeth developed so far as the total is concerned. There is, however, a very considerable amount of variation present in different individuals, both with regard to the number and also the form of the teeth in front of the large premolar.

The pouch.—This varies very much according to the time of year at which the animal is caught; and judging from the examination of a considerable number of female specimens caught at various times, I think that the breeding season will be found to be in or about November.

The largest pouch present (in a specimen captured in January) measured from its very posterior to its anterior end 17.5 mm., though the portion enclosed by the ventral wall measured 9 mm. The opening is thus an elongate, backwardly-sloping one. The greatest width of the pouch was 12 mm. and the depth 8 mm. It is divided into two halves by a ridge on the abdominal wall, in such a way that at the anterior end two lateral bays are completely separated off from each other for a short distance. Two mammary elevations, placed one at the commencement of each lateral bay, are present of considerable size, and (after the animal had

been preserved in alcohol) they are hard, smooth and white, with a very distinct little brown nipple at the apex of each. They are in appearance very unlike the mammae of other marsupials; so much so, that until we examined them closely, Mr. Byrne and myself both thought that they were the smooth naked bodies of small pouch embryos attached to the teat, and that the little brown nipple was the minute tail.

The most curious point, however, in regard to the pouch is that, in examining thirty specimens, eight of them showed what I took at first to be the commencement of the development of the pouch, which varies considerably in size in the female. Though the indentation of the skin was slight, it was at once recognisable when the thick hairs covering the abdomen were pushed to the sides so as to leave the middle line relatively bare. It lies about 8 mm. in front of the anus—just the right position for a minute pouch—and has, moreover, a few very dark brown hairs arising from the indentation, exactly such as are present in the well-developed pouch of the female.

Dissection of two of the animals proved at once that they were males, so that in *Notoryctes* *there may be developed the rudiment of a pouch in the male.*

Marsupial bones.—In the original description of *Notoryctes*, drawn up from specimens which were not in a good state of preservation, these were described as small nodules in the tendon of the external oblique muscles of the abdomen. In three of my specimens in a good state of preservation, which have been examined, the marsupial bones are well developed, each is 4.5 mm. in length, and they diverge as usual from the anterior border of the pubic symphysis.

Reproductive organs.—From the examination of female specimens, in which the pouch is well developed and shows two mammae (as already described by Dr. Stirling), we have been able to determine the structure of the reproductive organs. The only satisfactory way of doing this is by means of serial sections, which show that they are formed in a typical marsupial manner, with two lateral vaginae. The median canal is closed, and the structure of the organs is closely similar to that of *Hypsiprymodon*.

So far as the reproductive organs are concerned, they show, as every other organ of the body does, that *Notoryctes* is merely a marsupial modified so as to adopt the burrowing habit. It is in no manner whatever an intermediate form between Monotremes and Marsupials.

Notoryctes, though essentially a burrowing animal like the European mole, differs from the latter in not forming a permanent burrow; that is, it has no

“run” such as the European mole constructs, though, at the same time, it is quite probable and, in fact, almost certain that it burrows deep down into the more solid ground, and there, during the breeding time, the female probably remains. When in search of food, it must make its way through the surface sand, which is much too loose to allow of a permanent burrow being formed.

There is some doubt as to the nature of its food. It has been stated that ants attack *Notoryctes* rather than *vice versa*. In one of the earlier specimens which came into my possession there were certainly a number of ants, or rather the remains of these, clinging to the fur. The stomach of the same specimen contained the remains of ants and also the hard “shells” of ant eggs. It is really very difficult to see how any ant could annoy *Notoryctes*. The fur is so thick, close and fine that no ordinary ant could do more than get entangled amongst it, whilst, where the hair is absent, the surface is encased in a leathery integument.

Mr. Bishop, of Idracowra, to whom Dr. Stirling has previously expressed his indebtedness, found that *Notoryctes* would feed upon the larval form of a beetle commonly known as “witchetty.”

I think there can be no doubt but that *Notoryctes* will feed upon anything available in the way of insects or insect larvæ with which it comes in contact; but, on the other hand, I do not think it likely that its normal food is the “witchetty.”

The latter lives, when found amongst the sand-hills, in the roots of certain plants, such as *Acacias* and *Cassias*, and the teeth of *Notoryctes* are not such as to fit it for gnawing. On the other hand, when it is travelling, and presumably in search of food, *Notoryctes* moves along in the sand near to the surface, where in Central Australia it is quite certain to come in contact with ant-nests.

There are amongst the marsupials of Central Australia two which are especially fitted to prey upon ants. One, *Myrmecobius*, has become modified, with its long tongue, to feed upon them above-ground, and the other, *Notoryctes*, has become modified to feed upon them and their eggs and larvæ under-ground.

The great degeneration of the eye in *Notoryctes* is associated also with its habits. It is difficult to understand how any animal which lives under the conditions in which *Notoryctes* does could have preserved eyes exposed on the surface of the head.

The fine grains of the sand through which it burrows would have been a fruitful source of irritation, resulting constantly in the production of inflammation, and more than counterbalancing the advantage to be gained from the possession of eyes when it did come to the surface, for it must be remembered that *Notoryctes* is in reality more a surface animal than the European mole.

The only way in which the blacks capture it is by accidentally finding it on the surface after tracking it up on the damp sand, which shows that it normally spends a part of its time above-ground.

As yet, unfortunately, we know nothing of the development, no embryos having been found in the pouch, so that even the conditions of the newly born young with regard to the eyes is unknown.

Order **Monotremata.**

Family **ECHIDNIDÆ.**

(1) *Echidna aculeata*, var. *typica*, Shaw.

Despite the arid nature of the country, the rocky and scrubby hills of Central Australia, abounding with ant-nests, are not unsuited to the Echidna, and it has apparently a wide distribution. The northern specimens, from the neighbourhood of Barrow Creek, are said to be very small in size; but the southern ones, caught on the desert sandstone hills near Charlotte Waters, are only perhaps a little smaller than the average mainland form.* The only difference between them and the typical form lies in the fact that they are considerably lighter in colour. The hair, instead of being deep brown or black, is yellowish brown—lighter than in the Tasmanian variety; while the spine tips are a not very dark brown instead of black.

DESCRIPTION OF PLATES.

PLATE I.

- Fig. 1.—*Phascologale cristicauda*. Female. Life size. 1a hand × 1. 1b foot × 1.
 „ 2.—*Sminthopsis psammophilus*. Male. Life size. 2a hand × 2. 2b foot × 2.

* It is usually stated (*vide* British Museum Catalogue, p. 381) that the Tasmanian variety is of a size “averaging larger than in the typical variety.” This is by no means true, as Queensland specimens are considerably larger than the Tasmanian form, whilst Victorian ones are quite as large.

PLATE II.

- Fig. 1.—*Phascologale macdonnellensis*. Female. Life size. 1*a* head, side view.
Life size. 1*b* hand × 2. 1*c* foot × 2.
- „ 2.—*Sminthopsis larapinta*. Male. Life size. 2*a* hand × 2. 2*b* foot × 2.

PLATE III.

- Fig. 1.—*Dasyuroides byrnei*. Male. Life size. 1*a* hand × 1. Foot × 1.

PLATE IV.

- Fig. 1.—Dorsal view of skull of *Dasyuroides byrnei*. × 2.
- „ 2.—Ventral view of skull of *Dasyuroides byrnei*. × 2.
- „ 3.—Lower jaw of *Dasyuroides byrnei*. × 2.
- „ 4.—Teeth of upper jaw of *Dasyuroides byrnei*. × 2.
- „ 5.—Skull of *Phascologale cristicauda*.
- „ 6.—Lower jaw of *Phascologale cristicauda*.
- „ 7-8.—Teeth of upper jaw of two specimens of *Phascologale cristicauda*. × 2.
Fig. 7 is drawn from an especially large specimen and shows the very large canine and also the presence of the small *p*⁴.
- „ 9.—Skull of *Phascologale macdonnellensis*. × 2.
- „ 10.—Lower jaw of *Phascologale macdonnellensis*. × 2.
- „ 11.—Teeth of upper jaw of *Phascologale macdonnellensis*.
- „ 12.—Teeth of lower jaw of *Phascologale macdonnellensis* to show the minute *p*⁴ which is very rarely present.



Fig. 1



Fig. 2



Fig. 2^o
xl

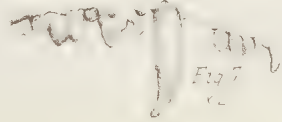
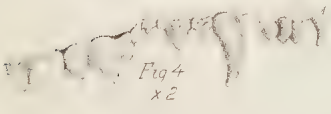
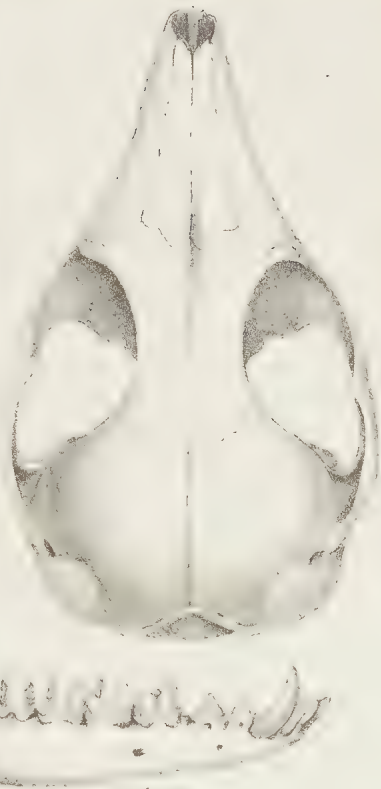
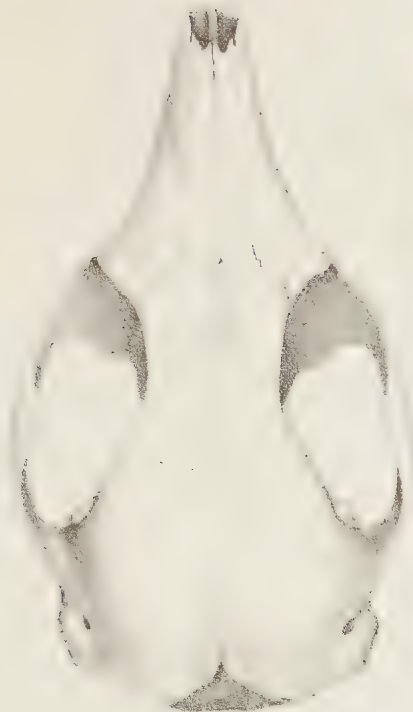
Fig. 2^o
xl



Fig 21
x2

Fig 22
x2







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