AIDS TO THE IDENTIFICATION

OF

Rats connected with Plague in India, with Suggestions as to the Collection of Specimens.

BY

W. C. HOSSACK, M.D.,

Plague Department, Calcutta.

Published by the Trustees of the Indian Museum.

2nd EDITION.

PRICE, EIGHT ANNAS.

PRINTED AT THE PIONEER PRESS,
ALLAHABAD.

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PREFACE TO SECOND EDITION.

The issue of a second edition has given me an opportunity to make a few slight additions to the original note. The most important of those is the paragraph calling renewed attention to the necessity for using a comparatively large amount of spirit. Unfortunately many of the consignments of rats which have been sent to the Museum up to date have arrived in bad condition with the hair coming off, as the result of neglecting to carry out the precautions called for.

WM. C. HOSSACK, M.D.,
Plague Department.

CALCUTTA:
November 2nd, 1907.

INTRODUCTORY NOTE.

The literature on Oriental rats is scattered in many scientific periodicals and other publications more or less inaccessible to the ordinary man, be he naturalist or doctor, who desires information regarding these important animals. Partly for this reason, and partly because the lust for the creation of new species burns so strong in the breasts of myologists, it is no longer possible for even a trained observer to feel confidence in this own identification of examples of many of the more obscure forms, without a prolonged preliminary study of the question. Although some obscurity still exists—and can only be dispelled by an examination of a large number of specimens from a large number of places—as regards even the common species found closely associated with man in India, the identification of these is even now in most cases more difficult than it need be. With a view, therefore, both of facilitating the diagnosis of the house-rats of India and of obtaining material for a more comprehensive study, it was suggested to the Government of India through the Board of Scientific Advice, that some co-ordination should be brought about among those working on rats, in connection with plague or otherwise, in different parts of India. As Government agreed that this was advisable and that the first steps should be taken by the Natural History Section of the Indian Museum, the present pamphlet was prepared. Its issue has been rendered possible by the energy of Dr. W. C. Hossack, who has recently devoted considerable time and patience to the study of Indian house-rats. Those who desire fuller information on the subject are referred to the more detailed account by the same author of the species occurring in Calcutta; this will be issued shortly by the Trustees in the first volume of the "Memoirs of the Indian Museum."

It is greatly to be hoped that those who are interested either in zoology or sanitary and medical science and have the opportunity, will assist the Indian Museum in the survey of the Indian rats which it proposes to commence, both by forwarding

specimens to the Museum and by recording the facts which are noted by Dr. Hossack as being of importance in connection with the identification of specimens. In any publication of results the collectors' names will be recorded and credit will be given them for any notes of which use is made.

All communications or parcels should be addressed to—

THE SUPERINTENDENT,
Indian Museum (Nat. Hist. Section),
Calcutta,

and will be duly acknowledged. It is hoped that arrangements may be made later for the distribution of simple measuring apparatus to those who undertake to assist the Museum.

N. ANNANDALE,
Officiating Superintendent.

INDIAN MUSEUM:
Calcutta, March 21*st* 1907.

A SHORT NOTE

ON THE

Indian Rats probably concerned in the propagation of Plague, with instructions as to the preservation and measurement of specimens.

The fact that rats play an all-important part in the propagation and maintenance of endemic plague has resulted in the issue of instructions from the Government of India for the preparation of a pamphlet for the guidance of Medical Officers and others engaged on plague work. The goal at which the pamphlet aims is that our knowledge of the rats chiefly concerned with plague, their habits and distribution, at present sadly deficient, shall be so extended and amplified that we may be able to collect a sufficiently comprehensive and accurate mass of facts to justify final and definite conclusions. It is proposed to attempt to achieve this aim by presenting a short and clear account which will make it comparatively easy for any one at all interested in the subject to identify the common rats occurring in his district, and in the second place by the preparation of a series of instructions as to the preservation and labelling of specimens.

As the result it is hoped that the authorities of the Indian Museum will soon find themselves in the possession of such an amount of well preserved and accurately described material as to enable them to attack the problems at present awaiting solution, problems that only a widespread and systematic collection of specimens can settle.

The great difficulty in dealing with rats from the zoological point of view is that in external appearance there is extremely little difference, so that, to one who is not an expert, specimens belonging to entirely different genera may present an apparently identical appearance. As a matter of fact, if sufficient attention is paid to minute details of measurement, such as the relative proportion borne by the hind feet to the total length of the head and body, there is little difficulty in separating genera, but with regard to species, particularly of the genus Mus, the points of difference relied upon are so minute and ill-defined that the subject is at present in a state of great confusion. Such differences as depend on minute variation in the configuration of the cranium and in the conformation of the teeth can only be dealt with by some one with technical knowledge and considerable practical

experience, and accordingly they will not be considered in this paper. The subject of body measurements will be gone into fully, as fresh measurements made by the man on the spot are the only ones that are of any use, owing to the very great tendency to shrinking and distortion in preserved specimens. Coloration will also be dealt with, as this again is better noted in the fresh specimen, as dried skins are apt to change in colour and minute points of difference to become obscured in spirit specimens. The preservation of specimens in spirit and other media, the preparation of dried skins and skulls, the proper labelling and noting of specimens, will also be gone into, and finally a short description will be given of the rats which, so far as is known at present, are probably of practical importance as propagators of plague.

BODY MEASUREMENTS.

The most important measurements are only four in number—

(1) Length of head and body.
(2) Length of tail.
(3) Length of hind foot.
(4) Length of ear.

They are most accurately taken by sliding callipers, but quite useful results can be obtained by means of a measuring tape, particularly a steel tape, or a pair of compasses and a measuring rule or tape. The measurements should be recorded in centimetres and millimetres, and for the convenience of those who have only an English scale to work from, a table is given at the end of this paper for the ready conversion of English into metric measurements. The length of the head and body is taken from the tip of the nose, excluding hairs, to the centre of the vent. The body should be straightened out, particularly if *rigor mortis* is present, and if a tape is used care must be taken that the tape is straightened and not allowed to follow the curves of the body. The length of the tail is taken from the centre of the vent to the tip of the tail, excluding hair. The length of the hind foot is taken from the point of the heel to the tip of the longest toe, excluding the claw; the foot must of course be straightened. Any abnormality in the pads of the foot, normally five in the forefoot and six in the hind foot in the common species, should be noted. The length of the ear should be taken from the lowest point of the external orifice to the tip, excluding hair.

PREPARATION OF SKINS.

If fresh measurements have been taken, dried skins and skulls are the most valuable material and are very easily packed and sent to their destination; skins without measurements are of very little use, as they get stretched out of all proportion. No time should be lost in skinning, as putrefaction in India may come on an hour or two after death. The only parts likely to cause trouble

are the feet and the tail. When about an inch of the tail has been skinned back the reversed portion should be firmly grasped with a duster or any old rough piece of cloth; it will generally be found that the skin will slip off quite easily like a glove from a finger. In large, thick-skinned rats like the bandicoot, in which the skin is very adherent and threatens to break, it may, however, be necessary to slit the tail on the lower surface and dissect the skin off.

In the hands and feet the skin must be reversed right back to the fingers and toes and the flesh scraped off the bones of the palms and soles. It will be found impossible to get the skin back over the limb unless a string has been previously tied to the toes or fingers. The limbs should be disarticulated at the hip and the shoulder and the bones roughly cleaned with a knife. The slit in the belly should be kept as small as possible. Powdered alum should be well rubbed in, with particular attention to the feet and tail; or if this is not available wood ashes may be used. The muzzle, ears and the feet should be brushed over with a little strong carbolic of a strength of one in three. Two or three days will be found sufficient to train any *dôm* to skin perfectly well.

PREPARATION OF SKULLS.

The very first thing is to secure a label with a number corresponding to the skin; I have had constantly to reject skulls owing to skinners neglecting this precaution. It is most conveniently affixed by means of a needle and thread passed under the zygoma, the arch of the cheek bone. In a young skull in which the arch is incomplete, the thread must be passed right round the skull. The skull is boiled for some hours and then the brains and remaining flesh are removed with a piece of turnedup copper wire, a crochet hook or the like. It should always be insisted that the skinner should remove part of the neck with the skull; unless this is done he is liable to cut away the back part of the skull, rendering it useless for purposes of measurement. He must also be cautioned not to damage the back part in removing the brains through the opening for the spinal cord. The lower jaw should be secured to the skull with thread.

PRESERVATION OF SPECIMENS.

Spirit is the most reliable medium in which to preserve specimens, if skins cannot, for any reason, be prepared, but no time must be lost after the animal has been killed, or putrefaction may proceed even in the spirit, and plenty of spirit must be used. The amount of spirit used is most important. If the bodies of the rats occupy more than half the receptacle so much of the spirit gets absorbed by the tissues that the remaining fluid is too weak to prevent putrefaction. To pack rats into a jar and then fill up the interstices with spirit, as is

frequently done, is absolutely useless. The best way to make certain of avoiding bad results is to keep the rats in a large bulk of spirit for about a week. They can then be transferred to a smaller receptacle more suited to packing and postage. It is well to add to the spirit carbolic in the strength of 1 oz. to the pint, and the belly should be slit open to allow of penetration of the preservative medium. A glass-stoppered bottle is the best receptacle; the stopper should be luted with soft paraffin or sealing wax or pitch. Screw-topped jam jars will do, or for large consignments a kerosine tin may be soldered up, care being taken that the soldering iron is not too hot. Formalin may be used, but it must be remembered that in India weak solutions are absolutely useless; time and again I have received tins that contained little better than formalin rat soup. As the result of experiments I think that nothing under 15 per cent solution of formalin is to be depended upon in India, particularly with large and thick-skinned rats. This is equivalent to 6 per cent of formic aldehyde, as formalin, the commercial preparation, is a 40 per cent solution. Even with this strength it is necessary that no time should be lost between the death of the animal and its immersion in preservative.

Formalin is volatile, so the same precautions should be observed in sealing up as in the case of spirit. Specimens in the former preservative should not be kept for long in tins.

LABELLING SPECIMENS.

It will be found of the greatest service if a register is kept of all rats forwarded, or in other words of all rats measured, as skins or spirit specimens without fresh measurements are of comparatively little use. The register might be as follows:—

Register No.	Date of collection.	Locality (with altitude.	Sex	Length of head and body	Length of tail.	Length of hind foot.	Length of ear.	Number of teats	Remarks.

The date of collection is important as an index to seasonal changes of coat; the number of teats is rather important, as the number and distribution vary in different species. The most

convenient form of record is exemplified as follows :—$\frac{2}{3}$; the upper figure means 2 pairs of pectoral or breast teats while the lower figure means 3 pairs of abdominal teats. An asymmetrical distribution may be indicated as follows—$\frac{2}{3}+\frac{2}{2}$, the teats of the right side being given first. A ticket with the register number, or still better a ticket with number and full measurements, should be attached to the rat before it is handed over to the skinner, with a duplicate ticket for the skull. The method of labelling of the skull has already been described ; the material of the skull label is important as the skull has to be boiled. Tin foil which is quite soft and can be easily perforated and scratched is best ; lead or a piece of ordinary biscuit tin will do. In the column for remarks it should be stated whether the rat is found dying in numbers in the plague season, *i.e.*, whether it suffers from plague, if positive information on the subject is available.

The advantage of the register is that in case of a label becoming partially destroyed or illegible a reference to the register is all that is required. The advantage of the fully written up label is that a huge amount of work is saved at headquarters.

YOUNG RATS.

Considerable difficulty may be caused to the beginner if he does not know how to recognize a young rat, as its general appearance and proportions may differ considerably from that of the adult. The coat tends to be grey and furry, almost mole-like, owing to the grey underfur showing up through the longer hairs ; for the same reason the belly is much darker than in the adult. The head is proportionately large, but the foot is a much more certain and easily recognized guide. It may be relatively almost twice as large as in the adult. The rule may be laid down that if the hind foot is as much as 30 per cent of the length of the head and body, the rat is a very young one, only just cutting its third molar, and has only attained 50 or 60 per cent of its full length. In the full grown adult the hind foot is only about 20 per cent of the body length, and in an exceptionally large and old specimen may be as low as 16 per cent. In some of the Nesokias the foot may be very large even in the adult (as much as 25 per cent), so that the rule has to be somewhat modified, but this is a point on which more information is required, particularly as to the size of the foot in immature specimens.

COLORATION.

The coloration of rats is a character on which considerable stress has been laid as a means of differentiation, much more indeed than is justified. A large number of rats have very much the same colour, and the minute differences that are sometimes described are vitiated by the fact that the great range of colour which may be present in different individuals of the same species

has been insufficiently recognized. It therefore becomes all the more important that accurate observations should be collected as to variations normally found in different species in different localities. This is not quite such an easy matter as might at first sight appear, as nothing is more difficult than to describe accurately the tints and shades of tints to be found in the fur of an animal. To meet this difficulty a scheme of standard colours has been drawn up, known, by the name of its inventor, as "Ridgway's Scale of Colours for the Use of Naturalists"; a few of the colors which are most commonly mentioned in standard descriptions of rats have been reproduced, by hand in the plate. When the full scheme is used for reference the difference between the shades will be found so fine that it is no easy matter to decide which name to use to describe the particular colour under observation. Those who are accustomed to the use of colours, particularly water colors, are advised to refer to shades in terms of ordinary paints and to describe the animal as one would paint it. "Rufous" and "rufescent" are terms constantly used, but not in the strict sense of Ridgway's scale.* "Rufous" means a foxy red, "rufescent" brown with a tendency to foxy red. The light red which gives the "rufous" of Ridgway's scale is rarely seen in an animal's coat.

INDIAN RATS CONNECTED WITH PLAGUE.

Our knowledge of the rats that play an active part in the propagation of plague is at present so deficient that it is quite impossible to give any satisfactory account of them. At the same time nothing is more likely to assist in the collection of the desired information, or to lighten the labours of the inexperienced observer, than a succinct account of the rats of common occurrence and likely to prove of interest and importance to the practical epidemiologist. There are many species which are of very rare occurrence, of which only a few specimens are known, and which, in spite of their great interest to the zoologist, need not be considered at all by the epidemiologist. These, exemplified by *Mus blanfordii*, *Mus bowersi*, *Mus berdmorei*, *Mus fulvescens*, I shall leave out of account altogether. There are others, mainly field-rats, which, from their habits and distribution, probably play only a negligible part in the upkeep and spread of plague. These cannot be neglected altogether in view of the warning already given in the case of *Nesokia bengalensis*, a rat which on the strength of its being a field-rat has been left out of account altogether not only by the epidemiologists but also by the zoologists to whom they appealed. This rat has nevertheless been shown to be of great practical importance in Calcutta. Accordingly I shall give a brief mention of the most important of those rats with no attempt at a full description. The third category is that of the rats which are known to be the chief factors in the spread of plague

* In Ridgway's scale "fulvous" and "tawny" are regarded as synonymous terms.

and of one or two which are house-rats of sufficiently wide distribution and common occurrence to make it important that they should be definitely recognized. Of these a short account will be given, non-technical as far as possible, but sufficiently full to make their identification a simple matter. Mice I shall leave out of consideration altogether, as although *Mus musculus* has been found infected in Australia, and although I have, as a rare exception, found mice dying of plague in Calcutta, I consider them of very little practical importance. The third category as the most important will be the first to be dealt with and will comprise the following:—

1. *Mus rattus, the Black Rat.*
2. *Mus decumanus, the Brown Rat.*
3. *Nesokia bengalensis, the Indian Mole Rat.*
4. *Nesokia bandicota, the Bandicoot Rat.*
5. *Nesokia hardwickii, the Short-tailed Mole Rat.*
6. *Mus rattus* var. *nitidus, the Hill House Rat.*
7. *Mus concolor, the little Burmese Rat.*

Mus and Nesokia are two closely allied genera of the sub-family Murinæ belonging to the family Muridæ. The chief distinction between Nesokia and Mus may be broadly put as follows: the former are stout, heavily built rats with short, heavy, broad heads, an arvicoline or vole-like aspect, large feet and large molars in which the division of the tooth into transverse laminæ is much more marked than the division of the sinuous laminæ into cusps as it is found in Mus.

1. MUS RATTUS—THE BLACK RAT OF ENGLAND.

This is the common house-rat of India and the rat that is the most important in the propagation of plague, as from its habits it is brought into very intimate contact with man and is accordingly more liable than any other to infect him through the medium of its fleas. It is a slender rat with a very pointed muzzle, large out-standing ears, large prominent eyes and a long tail, as a rule 25 per cent. longer than the head and body. The feet are of medium size but comparatively long and slender. In size it is very variable, ranging from 14 cm. to 19 cm. in length of head and body. In color it is very variable also, but the most common type is a rather light rufescent brown with a white or grey belly. The grey of the belly may be orange-grey or sprinkled with fawn, and the white may be marked with a central stripe or spot of grey. Sometimes the whole coloration of the rat may be darker than usual, and the darkening may go so far that it is black. This occurs in 30 per cent. of those found in Bombay, but in Calcutta melanotic forms are rare. On the other hand, the colour may be much lighter than usual,—a pale yellowish or cinnamon-brown, and this may be so extreme that the rat is found yellowish, greyish or almost white. Though essentially a house-rat, living typically in the tiles of the roof, in the thatch, in holes in the floor, recesses behind boxes and such like places, it may be arboreal in which case it tends to be more slender, smaller and

lighter and more rufescent in colour. Two distinct varieties have been described,—*alexandrinus*, larger, heavier and typically found in Northern India, and *rufescens*, smaller, redder and typically found in Southern India. Recent work particularly in Calcutta seems to indicate that no sharp distinction can be drawn between the varieties, as both occur together and intergrade completely. Accordingly the name *Mus rattus* has been used and the terms *alexandrinus* and *rufescens* have been dropped altogether. The tail is uniform brown and regularly annulated; a white tip is exceptionally found. The teats are $\frac{2}{3}$. The distribution is probably cosmopolitan, ranging up to 8,000 feet according to Blanford. This rat is almost solely responsible for the plague of Upper India, as far as is known at present.

2. MUS DECUMANUS—THE BROWN RAT.

This is the brown rat of England, a sewer and ship rat probably introduced from Europe, though there are some that hold that its original home is China. It is confined mainly to ports and is, so far as is known, comparatively rare inland. It is a large heavy rat which may be distinguished by its bi-coloured tail, which is distinctly lighter below, its large heavy flesh-coloured feet, its short, round ears and broad heavy-jowled head. It is brown in colour, becoming grizzled below and fading off into dirty white on the belly. The ears generally fall short of the eye when laid down along the face, whereas in *Mus rattus* they generally cover the eye. The tail is heavy, uniformly tapered and averages 89 per cent. of the length of the head and body. The most common formula of the mammæ is $\frac{3}{3}$. Though a burrowing, drain-frequenting rat it is frequently captured in the upper storeys of houses. It exceptionally reaches a very large size in Calcutta,—as much as 11 inches in length of head and body, practically the size of the bandicoot. The different shape of its head and the comparative smallness of its foot will distinguish it. This is the rat most frequently affected by plague in Bombay.

3. NESOKIA BENGALENSIS—THE INDIAN MOLE RAT.

This has been in the past very frequently confused with the preceding rat, as in size and general appearance it is not unlike it. It is however a much more coarsely furred rat, the underfur being so thin that the naked skin can frequently be seen when it is enraged and erects its fur. The back is covered with very long black bristles 4—5 cm. in length, which are quite characteristic. When trapped it is generally very savage in demeanour, bristling its coat, spitting and snarling at one. The head and neck are short and thick and the whole body is stout. In colour it is a colder greyer brown than the brown rat and fades off to a dirty rusty white on the belly. The tail is characteristic, being rather short (81 per cent. of the length of the head and body), uniformly

brown, and distinctly attenuated at the tip. A glance at the foot will settle the question if there is any doubt, for it is relatively small, is not flesh coloured and the pads are characteristic. Instead of being large and prominent and as a rule heart-shaped as is found in the black and brown rat, the pads tend to be small and circular; that nearest the heel on the outside is small indeed, not infrequently it is wanting altogether, so that the usual six pads are represented by five. Occasionally the medium pads may be heart-shaped; in such the rudimentary condition or complete absence of the sixth pad will give the clue to identification. Though originally a burrowing field-rat which stores grain in its complicated burrows, in Calcutta it is found infesting stables, grainshops, and such-like places; it is capable of piercing even cement and brick. The mammæ are numerous, the most common formula being $\frac{4}{3}$ or $\frac{4}{4}$. Its distribution is very wide, as it is found over the greater part of the Indian Peninsula from the base of the Himalayas to Cape Comorin, and from Lower Sind to Cachar and Assam; it is more common in damp alluvial tracts but ascends to the top of the Nilgiris and other hills. It is found also in Ceylon and the valley of Kashmir, and apparently throughout Burma to the Mergui Archipelago. This is the most important plague rat in Calcutta; in both this city and in Dacca it accounts for about half of the total rat population.

4. NESOKIA BANDICOTA—THE BANDICOOT RAT.

Its excessive size makes it difficult to make any mistake as to the identity of this rat. It has occasionally been confused with very large specimens of the brown rat, but its extremely large, blackish feet, with foot pads as in the mole rat, should at once distinguish it. It has the same colour, the same bristly coat, and savage demeanour as the latter. Its head is different from that of the brown rat, as is shown in the sketches, being narrow and deep-muzzled like that of a greyhound. So far as is known, it is not generally liable to be attacked by plague. It is found all over the Peninsula of India and Ceylon. It is said not to be found in Sind or the Punjab, though common in Rajputana, the N.-W. Provinces and Bengal. The form found in Bengal is a smaller northern variety (*nemorivagus*) which is found also in Burma and the Eastern Himalayas; the southern form is larger and runs up to 30 cm.—37·5 cm. in length with a tail of 27·5 to 32·5 cm. and a hind foot of 6·25 cm. It is a burrowing, grain-storing rat.

5 NESOKIA HARDWICKII—THE SHORT-TAILED MOLE RAT.

The main reason for including this rat is that it has been sent for identification from Bihar in connection with plague operations. It is so purely a field-rat that it is doubtful whether it is of any importance. It has very large feet and a very broad,

round head. Its colour is yellowish to rufous brown above with a hoary grey or white belly. The fur varies in texture but tends to be long and soft. There are two varieties—*huttoni*, a soft-furred form with large feet found at high elevations in Baluchistan and Afghanistan and the typical form with darker, harsher fur and smaller feet, found in N.-W. India.

6. MUS RATTUS, VAR. NITIDUS—THE HILL HOUSE RAT.

This differs from the *Mus rattus* of the plains in that the tail is much shorter, almost the same length as the head and body, and the fur, as might be expected, is much longer and thicker. The flea found on this rat in Darjeeling is not *Pulex irritans* but *Ctenopsylla musculi*.

7. MUS CONCOLOR—THE LITTLE BURMESE RAT.

This is really a miniature *Mus rattus*. It has been included in the list of descriptions because it is the common house-rat of Burma and probably plays an important part in plague in that country. The colouring is the same as that of *Mus rattus* except that the belly is generally pale brown instead of white, grey or orange-grey. It is rather mouse-like in size but is structurally a small rat.

Amongst the field rats which probably are of very little importance, the commonest have already been described with the house-rats, as they are more liable than most to be found away from their proper haunts, namely, the Nesokias. The Gerbilli, of which the most common and well-known species is *G. indicus*, is too characteristic and too well known to require description. It is commonly called the antelope rat from the powers of leaping which it possesses ; its excessively long feet, large ears and very long tufted tail make it easy of recognition. *Mus mettada*, the soft-furred field-rat, is more like a large mouse than a rat, and can be at once recognized from the fact that it has only four or five plantar pads, generally four. It is found in most parts of the Peninsula of India and also in Sind. The musk-rat or the grey musk-shrew, *Crocidura cærulea* is not a rat at all but is one of the insectivora and does not seem liable to plague. Amongst the many other animals which are exceptionally attacked by plague none are worthy of mention together with the rats, except perhaps the squirrels. Where thatched roofs are the rule the squirrels may be as great a domestic nuisance as their first cousin the rats, and the former are apparently frequently attacked by plague, so that in some places they may be a factor of practical importance. Only two species need be considered—*Funambulus palmarum*, the palm-squirrel or common striped squirrel, and *Funambulus tristriatus*, the jungle striped squirrel. They are easily distinguished, as in the former the three pale dorsal stripes are broad and are so supplemented by the light colour below the lowest dark intervening stripe that the species might well be described as possessing five light stripes. In the jungle form the

three stripes are very narrow and are not supplemented by an ill-defined lower pair; this form may be found in houses where the domestic form (the palm squirrel) does not exist.

Throughout this pamphlet my endeavour has been to keep the language simple and free from technicalities; accordingly there have been no references to the history or literature of the subject; no discussions on disputed points; no mention of cranial measurements. Those who wish for information on such points are referred to my Memoir on the Rats of Calcutta, now being issued as part of the first volume of the "Memoirs of the Indian Museum."

CALCUTTA: 17*th March* 1907.

WM. C. HOSSACK, M.D.,
Plague Department.

TABLE OF AVERAGE MEASUREMENTS.*

	Head and body.	Tail.	Foot.	Ear.	Remarks.
Mus concolor ...	11	12	2·25	1·25	Miniature M. rattus.
Mus mettada	12·5	10·5	2·5	1·85	4 pads. Mouse-like.
Gerbillus indicus ...	15	18	3·75	1·5	4 pads. Tufted tail.
Mus rattus	17·3	20·97	3·31	2·12	House rat with long ears and tail.
Mus decumanus ...	22·6	20·2	4·15	1·97	Drain rat with short ears and bicolour tail.
Mus rattus *var.* nitidus ...	18·5	18 5	3·6	2·16	Hill house rat. Long ear, medium tail.
Nesokia bengalensis ...	18·22	14·79	3·19	1·95	Short attenuated tail, small round pads.
Nesokia hardwickii ...	16·5	11	3·05	1·25	Tail very short.
Nesokia bandicota ...	26 9	25·5	5·1	2·7	Largest Indian rat.

TABLE FOR CONVERSION OF INCHES TO CENTIMETRES.

Inches	Centimetres.	Inches.	Centimetres.	Inches.	Centimetres.
$\frac{1}{16}$	·15	$2\frac{1}{2}$	6·25	$7\frac{1}{2}$	18·75
$\frac{1}{8}$	·3	3	7·5	8	20
$\frac{1}{4}$	·6	$3\frac{1}{2}$	8·75	$8\frac{1}{2}$	21·25
$\frac{1}{2}$	1·25	4	10	9	22·5
$\frac{5}{8}$	2·1	$4\frac{1}{2}$	11·25	$9\frac{1}{2}$	23·75
$\frac{2}{3}$	1·66	5	12·5	10	25
$\frac{7}{8}$	2·2	$5\frac{1}{2}$	13·75	$10\frac{1}{2}$	26·25
1	2·5	6	15	11	27·5
$1\frac{1}{2}$	3·75	$6\frac{1}{2}$	16·25	$11\frac{1}{2}$	28 77
2	5	7	17·5	12	30

* All the measurements are in centimetres.

FIG. 1.

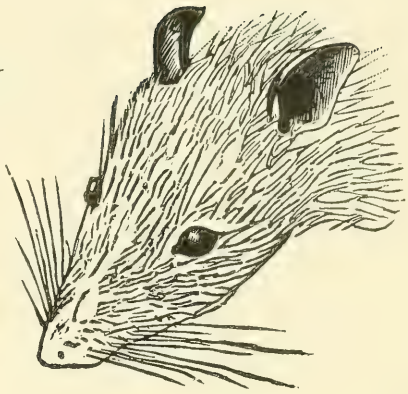

FIG. 2.

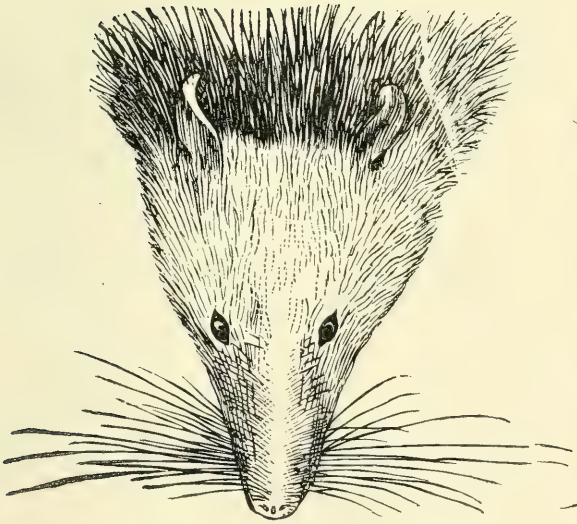

FIG. 3.

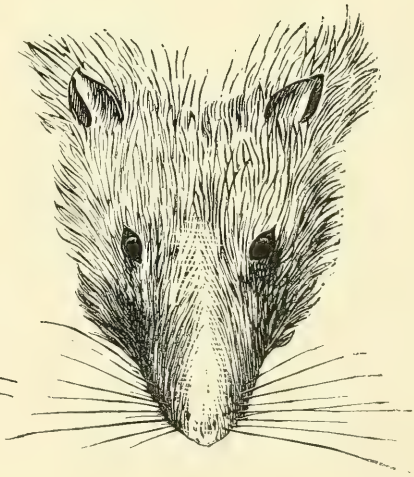

FIG. 4.

FIGS. 1 & 4—*Mus decumanus.*
FIG. 2—*Mus rattus.*
FIG. 3—*Nesokia bandicota* var. *nemorivagus.*

All natural size.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 5—Right hind foot of *N. bandicota*.
FIG. 6— Ditto of *M. decumanus*.
FIG. 7— Ditto of *N. bengalensis*.
FIG. 8— Ditto of *M. rattus*.

All the figures life size except Fig. 5, which is slightly reduced.

SPECIMEN COLOURS

(AFTER RIDGWAY)

FULVOUS

FAWN

BUFF

RUFOUS

CHESTNUT

TAWNY

ISABELLINE

OCHRACEOUS

BURNT SIENNA