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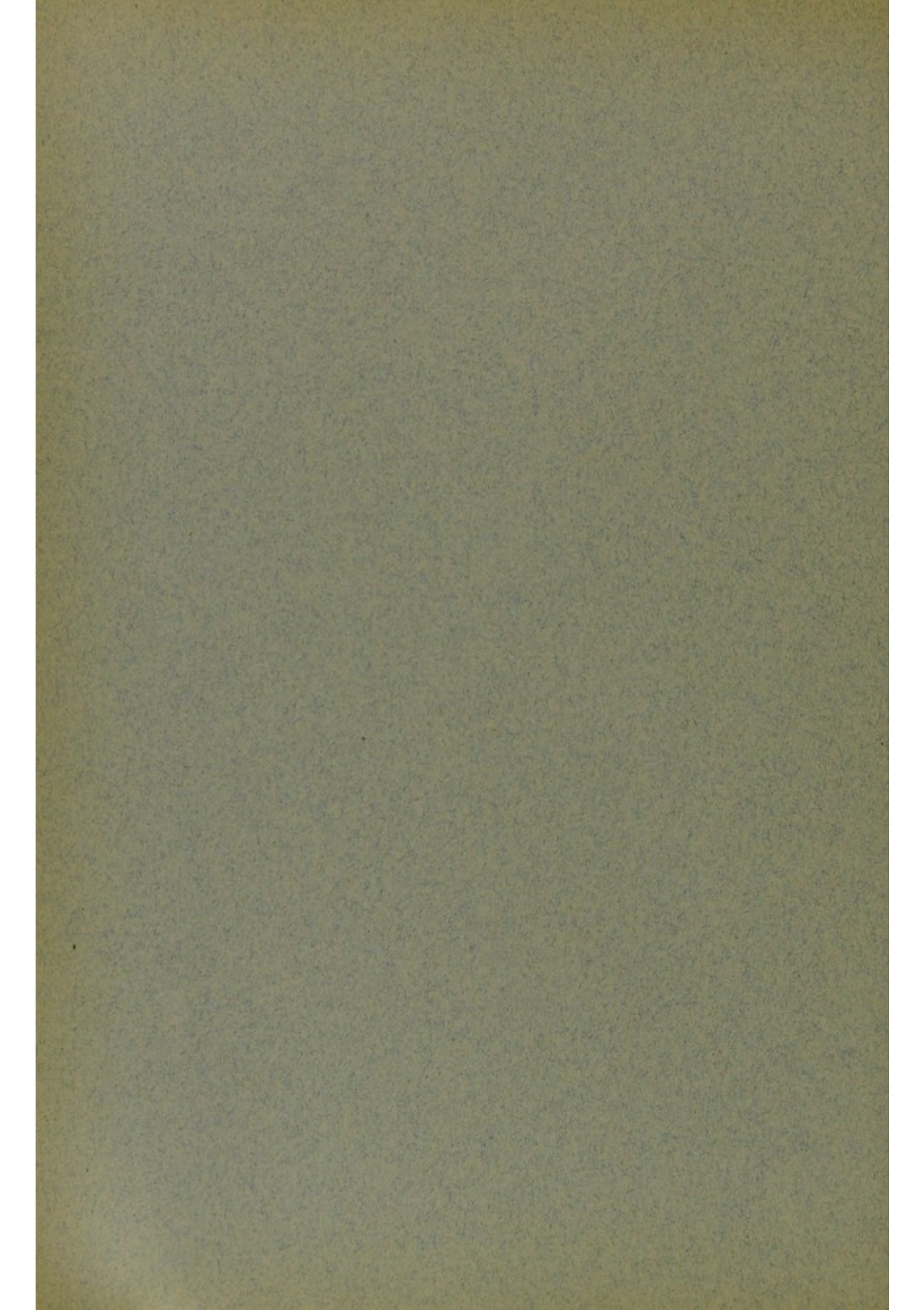
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ON THE ZOÖLOGICAL POSITION OF THE ALBINO
RAT

SHINKISHI HATAI, PH.D.



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From the WISTAR INSTITUTE OF ANATOMY AND BIOLOGY, Philadelphia.

ON THE ZOÖLOGICAL POSITION OF THE ALBINO
RAT.¹

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According to Leunis ('83) the black rat (*Mus rattus*) was known in Europe as early as the twelfth century, while the Encyclopedia Britannica (Olfeld Thomas, '86) states the appearance of the black rat to be at least as early as the thirteenth century. Although the statements by the different writers as to the appearance of the black rat in Europe do not quite agree, yet it is clear that the arrival of the black rat was much earlier than that of the brown rat (*Mus norvegicus*)² which, according to various records, appeared in Europe at about the middle of the eighteenth century, or a little earlier.

Although both species of rats are described as originally natives of Central Asia, yet they are everywhere enemies. By the incessant competition between these two forms, the black rats were almost exterminated, first from Europe, and later from the greater part of North America, and at the end of the eighteenth century, the brown rats were alone found in abundance in these regions.

It is often stated that the white rat at present found in captivity, is the albino of *Mus rattus*. In support of this view there are a number of statements to be found in the older literature (Donndorff, 1792). (No effort has been made to examine the records previous to Linneus).

It is apparently on the basis of these records in the older literature that the current statements in popular natural histories and in encyclopedias are based.

On the other hand, in the zoölogical literature in the nineteenth century, there are numerous statements which refer to the albino rats as a variety of *Mus decumanus*.

¹ From the Wistar Institute of Anatomy and Biology at Philadelphia.

² *Mus norvegicus*, Erxleben = *Mus decumanus* Pall. of older Zoölogical Literature. *Norvegicus* has priority, and has come into general use within the last two or three years.

Von Fischer ('69) in a catalogue of the mammals of the St. Petersburg Government, makes the following statement :

"Die Wanderratte, *Mus decumanus* Pall. (russisch Krýssa — Krýssa heist eigentlich *Mus rattus*, diese art ist bekannt unter dem namen Passjúck) kommt ueberall massenhaft vor in allen Farben ; schwartz, schmutziggrau bis rostgelb, weissgescheckt und auch ganz weiss. "Die Hausratte, *Mus rattus* L., habe ich nie gefangen, weshalb ich annehmen zu dürfen glaube, dass diesse Ratte hier auch nicht vorkommt."

Von Fischer ('74) used a white *Mus norvegicus* in his experiments on the production of hybrids. Later Crampe ('85) also used a white *Mus norvegicus* in experiments of the same nature.

Haacke ('95) and Bateson ('03) studied the crosses between the white *Mus norvegicus* and the common brown rat. None of the authors, however, describe in detail the white forms which they employed.

Despite the general belief to the contrary, there are many reports in recent literature indicating that groups of *Mus rattus* are still to be found in a number of localities, both in Europe and the United States.

In the United States, *Mus rattus* is reported from Texas, Florida and other southern states, and also from Iowa. Rhoads ('03) reports a number of new localities in the States of Pennsylvania and New Jersey. It has been learned through Director Dr. Seitz that in Germany the black rat is present in large numbers in the buildings connected with the zoölogical garden in Frankfurt a/m.

It may be interesting to note that the occurrence of white rats in a wild state has been reported from two localities in Iowa, by students working in the neurological laboratory at the University of Chicago. There are no means of determining, however, whether these were albinos of the black or brown rat. From this review it is evident, therefore, that there are, or have been, at least two forms of albino rats.

Since 1893 a colony of albino rats has been maintained in the neurological laboratory at the University of Chicago, and in 1906 a similar colony was established at the Wistar Institute of Anatomy at Philadelphia.

These colonies have been recruited for the most part from the northern states of the Atlantic seaboard, but some specimens have come from as far south as Missouri. All the rats received from these various localities have appeared to be of the same variety, and have always bred true.

Heretofore, the specific similarity of the albinos and the other forms has been concluded from observation of the external characters only. Wishing more exact information as to the zoölogical relation of the rats composing these colonies, the present investigation was undertaken to determine whether we were dealing with an albino variety of *Mus rattus* or *Mus decumanus*.

Externally, *Mus rattus* is usually distinguished from *Mus norvegicus* by the following specific characters :

Mus rattus is smaller in size. The tail of *Mus rattus* is considerably longer than the body, while in *Mus norvegicus* it is either shorter or only slightly longer than the body, but not relatively as long as that of *Mus rattus*.

The following measurements, though incomplete, serve to indicate this relation :

TABLE SHOWING LENGTH OF BODY AND OF TAIL.

Observer.	<i>Mus rattus.</i>			<i>Mus norvegicus.</i>		
	Length Body.	Length Tail.	No. of Obser.	No. of Obser.	Length Tail.	Length Body.
New International Encycl..	21 cm.					27 cm.
Leunis	16 cm.	19 cm.			19 cm.	24 cm.
Hatai				27 males	21 cm.	24 cm.

The general shape of the head (see Fig. 1) of *Mus rattus* is slender, the nose is sharper, and the ear is both wider and longer than in *Mus norvegicus*. It may be worth while to mention that the so-called Alexandrian rat (*Mus alexandrinus*) is said to have external characters similar to those of the black rat (*Mus rattus*) and these two species are only distinguished by their coloring, *Mus alexandrinus* having a brown colored coat.

If we compare the external bodily characters of the albino rat found in our rat colonies, with those of the brown rat, we are surprised by their close similarity. All these characters of the brown rat are also characters of the albino rats composing our

colonies. In other words, the common brown and our albino rats cannot be distinguished from one another by their external characters.

It is nevertheless true that the albino rats which we have examined, are smaller in size than the brown rats in the same localities. In fact, the absolute size of the albino rat is nearly intermediate between *Mus rattus* and *Mus norvegicus*. It is possible

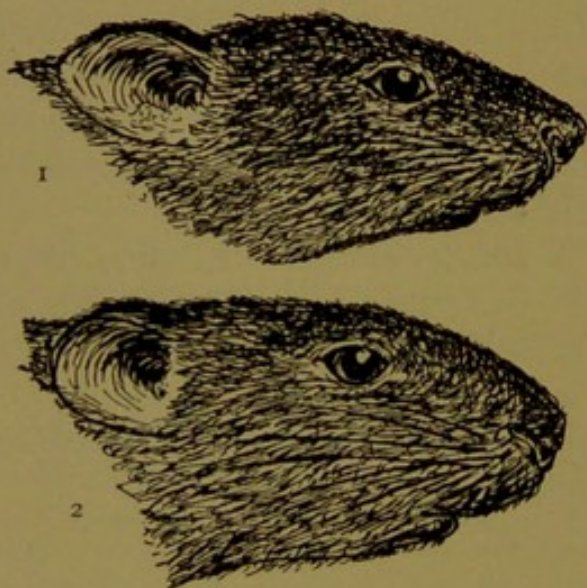


FIG. 1. Copied from "Encyclopedia Britannica," in order to show the shape of the heads of the brown and black rats. 1. *Mus rattus*. 2. *Mus norvegicus*.

that the confinement in which these albinos have been reared, accounts for their smaller size, as the result of lack of exercise and altered conditions of life. It is possible also that we have here a phenomenon similar to that described by Semper ('81) and De Varigny ('94) on snails, where the size of the animals diminished with the size of the vessels in which they were reared.

It was thought that the character of the skull might serve for a more exact distinction of the forms under discussion. We therefore examined and compared the skulls of *Mus rattus*, *Mus norvegicus*, and of the albinos.¹

¹ In order to make this comparison, it was necessary to examine as many skulls as possible, and I am indebted to Professor J. A. Allen, American Museum of Natural History, at New York, Professor Elliot, Field Columbian Museum at Chicago, Dr. Greenman, The Wistar Institute of Anatomy at Philadelphia, and Professor Merriam, National Museum at Washington, for putting at my disposal various series of skulls, possessed by their several institutions.



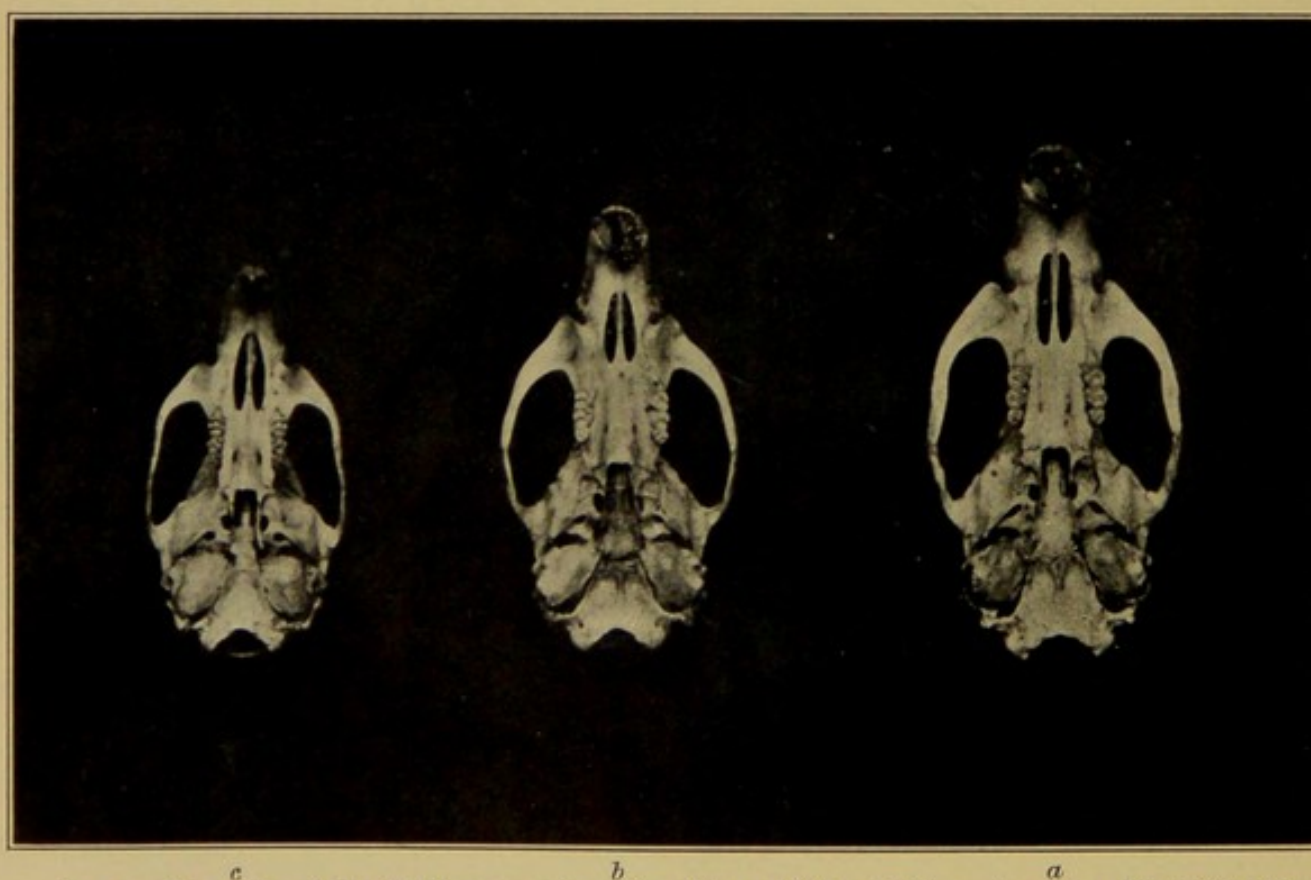
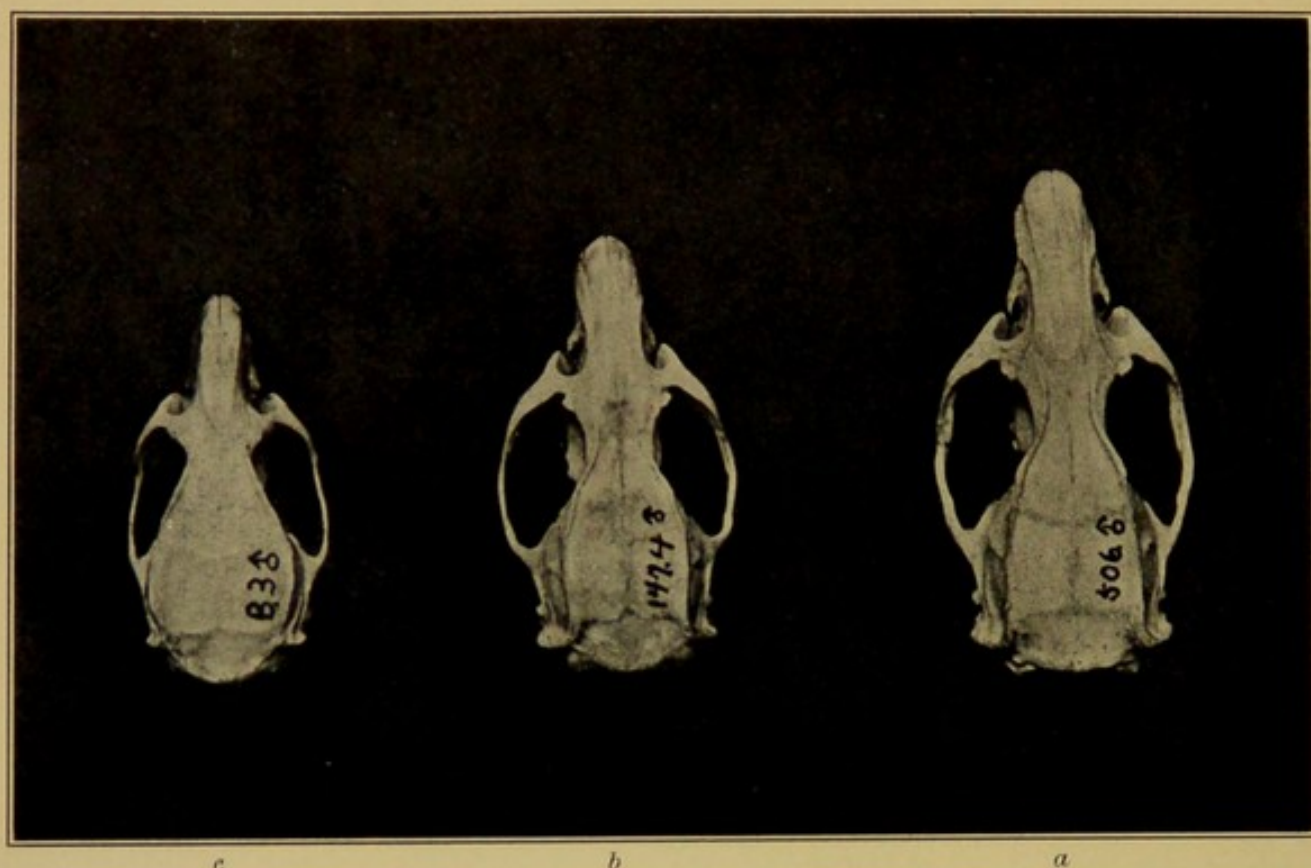


FIG. 2. Shows the skulls of *Mus norvegicus* (*a*), albino rat (*b*) and *Mus rattus* (*c*). The skulls were photographed from two different aspects, in order to show various views of the skulls for a comparison. The upper row was taken from the dorsal aspect, and the lower from the ventral. The figures are about the natural size.

To illustrate the differences found, both photographs and drawings have been made.

On comparing the skull of *Mus rattus* with the brown rat, the general unlikeness can be seen in Fig. 2.¹ The most noticeable difference is in the shape of the cranium.

When viewed from the dorsal aspect, the cranium of *Mus rattus* is oval in the outline, while that of *Mus norvegicus* is somewhat rectangular. Moreover, the dorsal aspect of the cranium in *Mus rattus* is decidedly convex, while in *Mus norvegicus* it is nearly flat. In *Mus rattus* the os nasale as compared to the entire length of the skull, is relatively shorter than *Mus norvegicus*. In *Mus rattus*, the outline of the os interparietale is somewhat semilunar in shape, while in *Mus decumanus* it is rectangular. In *Mus rattus*, the os parietale is broader as compared with its length, than in *Mus decumanus*. In *Mus rattus*, the foramen magnum is subcircular in outline, while in *Mus norvegicus* it is somewhat rectangular. On the ventral aspect of the skull, the large tympanic bullæ in *Mus rattus* are more conspicuous and eminent than in *Mus norvegicus*.

The junction point of the os basi-sphenoidale and os basi-occipitale is flat in *Mus rattus*, and protrudes in *Mus norvegicus*. The anterior end of the maxilla which forms the lateral wall of the infraorbital fissure, is blunter in *Mus rattus*, than in *Mus norvegicus*. The skulls of our albino rats are very similar in the above characters to those of *Mus norvegicus*, and the description of *Mus norvegicus* may be taken to apply to them.

In connection with the shape of the skulls, the determination of a cranial index has been made. The index used, was that obtained by dividing maximum width of the cranium by the length of the fronto-occipital line. (See Fig. 3.) On account of the small number of specimens measured, the accompanying table is to be considered as merely preliminary, but as it stands it shows a similarity in this index between *Mus norvegicus* and the albino rats, and a difference between these two forms and *Mus rattus*. The cranial index will be made the object of a more extended investigation.

¹ Care has been taken to use only the skulls of fully matured animals. See J. A. Allen ('94) and H. C. Merriam ('95).

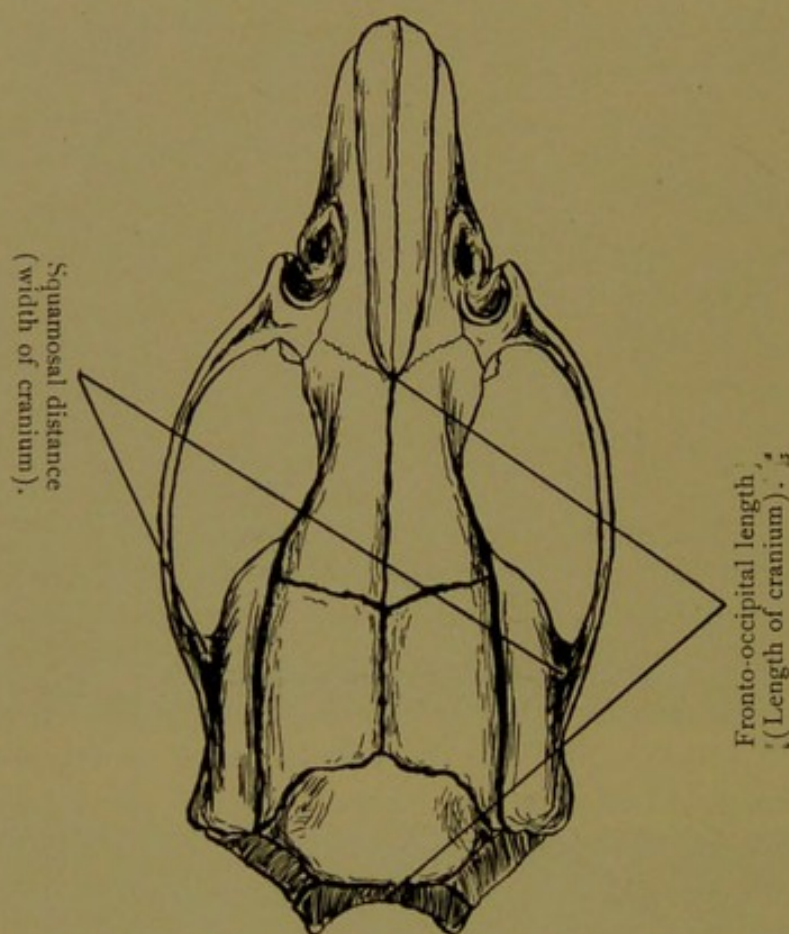


FIG. 3. ($\times$ two diameters.) The measurement of frontal-occipital length was determined in the following way :

Since the length measured from the tip of the nose to the posterior end of the inter-parietal bone, is not always equal to the length measured from the tip of the nose to the end of the occipital bone, both measurements were taken. First, the measurement from the tip of the nose to the end of the occipital bone, and second, that from the tip of the nose to the end of the inter-parietal bone. The difference thus obtained, was added to the length of the frontal-interparietal line, and the sum was called frontal-occipital length.

The width of the cranium was determined by taking a maximum width between the two points (right and left) where the zygomatic bones rest on the lateral walls of the cranium.

We conclude therefore, that the albino rats composing the colonies at Chicago and Philadelphia, are similar to *Mus norvegicus* in their bodily proportion, and in their cranial characters. They are however, smaller in size than the specimens of *Mus norvegicus* usually found.

TABLE SHOWING CRANIAL INDEX.

Males.	Cranial Index Average.	Extremes.	No. of Rats Used.
<i>Mus rattus</i>	.60	.58-.62	8
<i>Mus norvegicus</i>	.54	.51-.55	12
Albino rat.	.54	.50-.56	12

Nevertheless this form is to be regarded as an albino variety of that species and to be designated *Mus norvegicus* var. *albus* (*oculis rubicundis*).

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