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EIGHTEENTH CENTURY JAPANESE MOUSE MUTATIONS

Frontispiece

Illustrations from "Chingan-Sodategusa," a Japanese mouse-breeding guide published in 1787. Three grades of piebald are shown (A, B, D) and at C a dwarf, (left) and a black eyed white (right). The directions given in this booklet for breeding various color patterns in the mouse do not all fit into the modern genetic scheme, but many of them prove to be well founded by modern genetic research. The figures reproduced above appear on pages 12 and 13 of the original booklet.

AN EIGHTEENTH CENTURY JAPANESE GUIDE-BOOK ON MOUSE-BREEDING

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WHILE looking for old records of mutant strains of the mouse, I came across a copy of "Chingan-sodategusa" ("The breeding of curious varieties of the mouse") in the Tokyo Imperial Library. More recently, another copy of the same book came to the hand of Dr. Nakamura of our laboratory and was kindly shown to me. It is quite a small book, 156 mm. long and 104 mm. broad, having fourteen pages in all, and was written in 1787 by one Chôbei Zeniya, a resident of Kyoto. The career of the author is now obscure; but judging from his name, he was probably a man engaged in the money exchange business.

The book begins with a chapter on the origin of the albino mouse in Japan, and contains various accounts of the technique of the breeding and rearing of the mouse. The most interesting of all are the descriptions of various mutants of the mouse and the discussion of their mode of inheritance. There are, naturally, some ridiculous mistakes in the author's theories and a good many meaningless and traditional notes. However, the main part remains worthy of our notice even with our knowledge of modern science, as it rests on substantial experiments. I am confident that the main part of the book merits translation into English as an old record of mutant strains of the mouse and of their mode of inheritance. This I am presenting below, the translated passages being in italics, and following them some elucidations of sentences that do not bear direct translation and some remarks when they seem necessary. For the sake of brevity, the preface and the chapters relating to the technique of caring for the mouse are omitted.

EXCERPTS FROM "CHINGAN-SODATEGUSA"

Origin of the Albino Mouse in Japan

In one of our proverbs a good diligent clerk or faithful servant is compared to a white mouse; the reason of which is as follows: A Chinese Buddhist-priest, In-gen by name, who afterwards erected the Obaku Temple (at Uji near Kyoto), came over from China in the autumn of the 3rd year of Shô-ô, in the reign of Gokômuyô-in, the one hundred and eleventh Emperor (1654). At that time he brought with him a pair of black-eyed white mice as his pets. In Japan, the followers of the priest daily increased in number and his temple became full of pilgrims. Then the mice were given to an enthusiastic applicant whose earnest request the priest could not refuse. The man took good care of the mice, and the more he prized them the richer he became. Moreover, his posterity enjoyed long prosperity, etc.

Concerning the origin of the oriental tame mouse (*Mus bacterianus* var. *albula*) and its famous variety, the so-called "dancing mouse" (*Mus bacterianus* var. *rotans*), it is uncertain whether they originated in Japan or in China, or some other place in Asia. The dancer variety is called "Chinese" or more often "Japanese" dancing mouse. Brehm (1890), who first introduced the dancer in Europe, applied the name "Japanese" to that mouse

merely because of the ill-grounded communication of an animal dealer who brought the mouse from Japan. Subsequently, several investigators tried to verify the real origin of the variety. Yerkes wrote in 1907 to two Japanese zoologists, Mitsukuri and Hatai, for information about the tame mice in Japan. But he could only find out that the albino mouse was called "Nankin-nezumi" in Japan, the name implying that the mouse had been introduced from China. On the other hand, he ascertained that the Chinese deny its origin in China and call it "foreign mouse." Thus Yerkes vaguely concluded that the race had been originated first in China, and was introduced into Europe and America through Japan. Fortuyn (1912), from a morphological study of the dancer, pointed out that the race was probably derived from the common Asiatic species, *Mus bacterianus* (*wagneri*), and not from European *Mus musculus*. However, he did not compare the variety with other Asiatic species such as *Mus molossinus* and *Mus caroli* which are found in Japan. Sharp (1912)* suggested that the dancer was derived, at least in part, from *bacterianus* of Tibet. However, there still remain some authors who believe that the mouse originated in Japan, for on a Netsuke or toggle kept in the Louvre are carved several mutants of the tame mouse (Schulumberger, 1894), and Masateru, the carver, lived during the last part of the eighteenth century and the first part of the nineteenth century—this fact indicates that the mouse was already common in Japan at that time.

The above-cited old record of the origin of the tame mouse in Japan merits special attention, although its authenticity is somewhat doubtful. At any rate it seems fairly certain that the tame mouse of Japan came from China, wherever its native place may have been.

Mutants and Breeding Directions

Case 1: When the black spotted mouse is mated with its own kind,



AN ALBINO MOUSE

Figure 1

Illustration of a boy holding an albino mouse appearing on page 5 of "Chingan-Sodategusa." It appears from this early record of the tame mouse in Japan that it came from China at least as early as 1654. The wild species from which the tame mouse originated has not been exactly determined.

black spotted offspring are usually obtained. But, in a few cases, lilac colored mice may be found.

Non-agouti spotted mice mated *inter se* breed true in the general case. Only when both parent mice carry the

*Cited from Keeler's "The laboratory mouse." 1931, p. 16.

pink-eye factor (p) in heterozygous condition, some of their offspring may be lilac-colored, as pp changes non-gouti to lilac.

Case 2: The cross between the red-eyed albino female mouse and the black spotted male mouse produces self-colored black mice. If one of the females among the offspring is crossed with a black spotted father, there will result black mice with white bellies or breasts marked with a white crescent.

The specification of the sex in the above description is unnecessary from the present genetic viewpoint. However, the import of the description may be explained as follows: if the albino parent in this cross happens to be of the genetic constitution $ccaa----SS$, it will throw black young in the F_1 generation. Next, if such F_1 animals (Ss) are back-crossed with the ss parent, self-colored and spotted are expected in equal numbers in F_2 . But, actually, the coloration of ss animals shows gradations between solid colored and white with dark eyes, so that there may result such individuals as are indicated in the description.

Case 3: From among black spotted mice, choose a pair of very slightly colored animals, and cross them. From among this offspring pick out the least colored individuals and cross them. By repeating this procedure you may eventually get black-eyed white mice. These are the ones that people prize highly as "white mice," and are to be distinguished from red-eyed whites.

It seems interesting to recall that this record of the technique of selection of color-patterns precedes Castle by about one hundred and twenty-five years.

Case 4: Black-eyed white mice always breed true when mated with

their own kind. If one of the offspring of such a cross mates with a male of any color, their young inherit the color of the sire only on the head, while other part of the body remains white as in the dam.

The so-called black-eyed white mouse in this book apparently differs from the real black-eyed white mouse which always carries the gene W , and is represented as $Wwss$. WW animals are known to die from anemia shortly before or after birth, and the black-eyed white does not breed true. Thus with the conception of the black-eyed white parent as one to be selected from $aass$ animals in the way stated in Case 3, it is difficult to explain the above description on a genetic basis.

Case 5: If a female black-spotted mouse is mated with a black-eyed white male, she sometimes bears young with lilac heads.

If both parents in this cross carry the pink-eye factor (p) in the heterozygous condition, pp individuals with lilac coat may be expected among their offspring.

Case 6: When a black-eyed white mates with lilac she produces young with eyes of ruby (?) color.

So and Imai (1926) have reported the ruby eye (p') in the oriented tame mouse beside the pink eye (p). P , p' and p are triple-alleomorphs, and are dominant in accordance with this order. If the black-eyed white parent happens to carry the p' factor in heterozygous condition, there may be seen some ruby eye individuals ($p'p$) in the offspring.

Case 7: When two pinks mate, they give pink. If one of the sons of such cross is back-crossed to the mother, "Azami" is produced. This color variety is rarely known.

"Azami" means dark pink. The "pink" probably represents some coat

color of the brown series. By association with a dilute or an eye-color factor brown readily takes a darker or a lighter tone.

"Mame-jiro" and "Mame-buchi"

In Mame-nezumi (dwarf?) pregnant females must not be kept apart from males, as separation delays the next bearing.

No further description on "Mamenezumi" is found through this book. The illustration (Frontispiece) shows that the breed has a considerably smaller body than the other varieties. This fact together with the name (Mame-small, nezumi-mouse) shows strongly that it is nothing but the mutant "dwarf" in modern mouse genetics. It may be questioned whether "Mame-nezumi" might not mean the mouse, while the other varieties mentioned in this pamphlet are mutants of the rat. Against this idea it may be pointed out that: (1) The old Japanese word for the mouse was "Amakuchi-nezumi" and there is no evidence that "Mame-

nezumi" has ever been used in its place; (2) The size of the animal in proportion to the child in the illustration (Figure 1) indicates that the animal is too small to be a rat; (3) Asymmetrical piebald is much rarer in the rat than the mouse, in the illustration a typical asymmetrical piebald is presented.

If "Mame-nezumi" is the dwarf, "Mame-jiro" and "Mame-buchi" seem to correspond with albino dwarf and spotted dwarf respectively.

On the last page there is an announcement that the second volume of this book will be soon published with the title "Shinsen-sansoroku" (Descriptions of three novel varieties of mice), in which the author proposes to describe the "red," "light yellow" and "lilac yellow" mice, and to disclose the secret of their breeding. This second volume would be no less interesting than the volume here described, but it is inaccessible to me as yet. It is even uncertain whether the volume was ever published.



U. S. Hunts Herdsman of Livestock Genes

The United States Civil Service Commission has announced an open competitive examination as follows: Senior Animal Husbandman (Genetics).

Applications for the position of senior animal husbandman (genetics) must be on file with the U. S. Civil Service Commission, Washington, D. C., not later than January 6, 1936.

The entrance salary is \$4,600 a year, subject to a deduction of 3½ per cent toward a retirement annuity.

Applicants must have been graduated with a bachelor's degree from a college or university of recognized standing upon the completion of at least 118 semester hours. Except for the substitution provided below, they

must have had six years of progressive responsible research experience in some phase of animal genetics. Each year of postgraduate study, the major portion of which was in animal genetics, will be accepted in lieu of one year of the required experience up to a total of three years. Additional credit will be given applicants who have had research experience with problems in livestock breeding.

Full information may be obtained from the Secretary of the United States Civil Service Board of Examiners at the post office or custom house in any city which has a post office of the first or the second class, or from the United States Civil Service Commission, Washington, D. C.