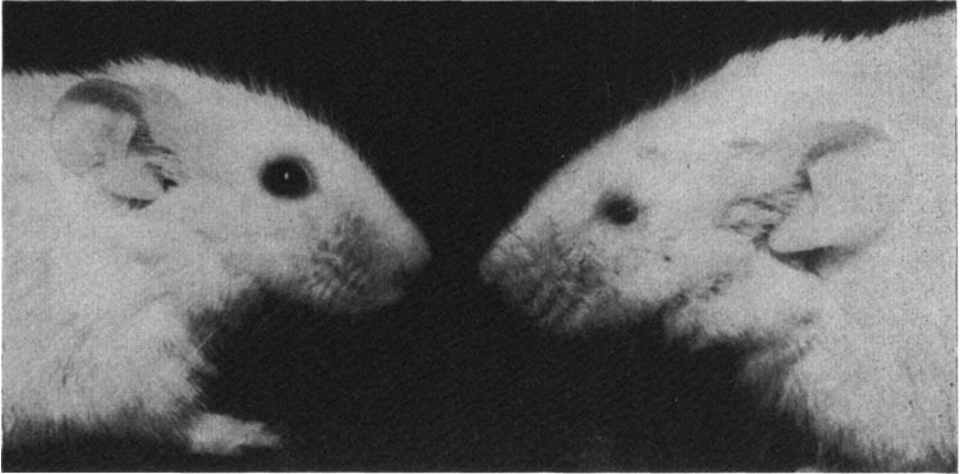


A NEW MUTATION WITH ASYMMETRICAL EXPRESSION IN THE MOUSE

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MALE LEFT EYE SMALL

Figure 4

The rule that inherited deviations are usually symmetrical is proved by an exception in this strain of mice. Shown in these two views are the normal right eye and the aberrant left eye of the same mouse. Females rarely show the small eye, and it is usually on the left side.

ALTHOUGH inherited variations in paired structures of bilaterally symmetrical animals are usually expressed equally on both sides of the body, exceptions have been reported in the literature, for example, ruby eye¹ in the mouse and microphthalmia² in the guinea pig. Another exception has recently been observed in mice in which microphthalmia was not only generally restricted to the left eye but also usually displayed by the male.

Materials and Methods

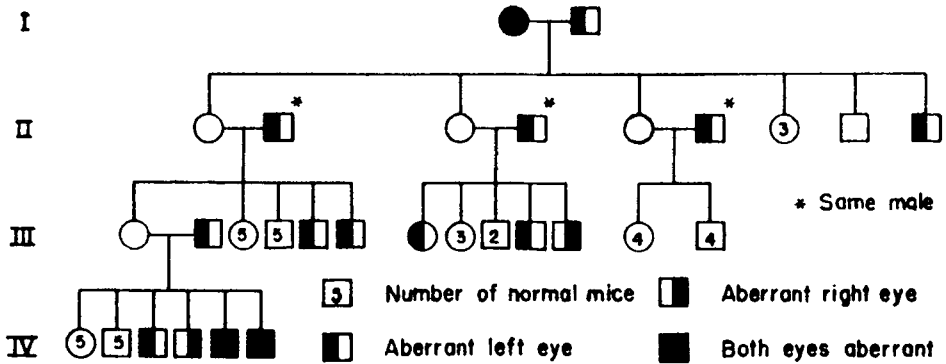
Microphthalmic mice were noted in the course of establishing inbred lines within the Namru strain developed by this laboratory from albino mice of ABC stock. Brother-sister mating has been rigidly followed to establish the inbred lines. The closed colony of Namru

mice has been maintained by pen breeding for the last six years and has been highly uniform as well as free from disease. Three males, each with an aberrant left eye, and one female with both eyes aberrant were found among the litters from a mating between a normal male and three normal females belonging to one inbred line. Additional microphthalmic mice have since been found in certain other inbred lines suggesting that the mutation was present in the colony and had been discovered in the inbreeding program.

The appearance of the aberrant eye was variable. In one mouse, the left eyeball was completely lacking while the right eyeball was normal in size and appearance. In other instances, the affected eyeball was markedly reduced in size (Figure 4). Noticeably opaque eyes were included in a third category. Occasionally, a reduced eyeball was opaque. None of the aberrant eyeballs was examined histologically.

Matings were made according to the following scheme:

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A PEDIGREE OF MICROPHthalmIA IN THE MOUSE

Figure 5

No simple explanation will account for the peculiar distribution of affected individuals shown here.

Type	Female	Male
1	normal	aberrant left eye
2	both eyes aberrant	normal
3	both eyes aberrant	aberrant left eye
4	normal	normal

Results

Matings between normal females and males with an aberrant left eye did not always yield litters containing microphthalmic mice. In the one cross between a female with both eyes aberrant and a normal male, only one mouse with microphthalmia was observed in two litters. A mating between the same female and a male with an aberrant left eye produced a single microphthalmic mouse. Males with an aberrant left eye were found in litters from crosses between apparently normal parents. Both litters from mating No. 146 included microphthalmic mice. These observations are summarized in Table I. A pedigree of microphthalmia is presented in Figure 5. The data indicate that microphthalmia occurs more frequently on the left side than on the right or on both sides (17/22); and more often in males than in females (19/22). The original four microphthalmic mice are included in the comparisons but not in the table. There was no significant deviation from the expected equal number of mice in each sex.³

Discussion

The application of simple mendelian formulae assuming complete penetrance to the data in Table I and the pedigree in Figure 5 has not been very successful in clarifying the genetic mechanism underlying the inheritance of microphthalmia. At first, the high incidence of affected males suggested sex-linkage. No manipulation of possible conditions offered a logical basis for this type of inheritance. Stern⁴ presents a discussion of two possible explanations for the difference in the sex-incidence of traits. The genetic explanation requires a multifactorial hypothesis in which one factor

TABLE I. A summary of matings between mice either displaying microphthalmia or yielding litters containing microphthalmic mice.

Mating No.	Mating Type*	Progeny		Males			Females	
		♀	♂	Aberrant Left	Aberrant Right	Both	Aberrant Left	Aberrant Right
26	1	0	0					
27	1	6	3					
28	1	3	2					
29	1	3	4					
76	1	6	7					
77	1	4	4	1				1
78	1	4	4					
146	1	5	9	1	1	2		
79	2	11	5	1				
5	3	6	2	1				
20	4	2	2	1				
22	4	6	6	1				
26	4	11	8	1				1
62	4	7	7	2				
169	4	7	4	1				
Total		81	67	12	2	2	2	

*Mating type refers to the scheme of matings presented in the text.

is sex-linked; the developmental explanation assumes that reactions and interactions induced by the genotype may proceed differently in male and female backgrounds. The appearance of a microphthalmic male in the progeny of a mating (No. 79) between a female with both eyes aberrant and a normal *A* strain male strongly suggests that microphthalmia may be due to a single dominant gene difference. The simplest hypothesis for explaining the inheritance of microphthalmia assumes that the responsible factor is an autosomal domi-

nant with incomplete penetrance and variable expressivity which yields a recognizable phenotype (microphthalmia) more frequently in the male than in the female.

Literature Cited

1. DUNN, L. C. *Proc. Nat. Acad. Sci.* 31: 343-346. 1945.
2. EATON, O. N. *Jour. Hered.* 28:353-358. 1937.
3. MACDOWELL, E. C., and E. M. LORD. *Anat. Rec.* 31:143-148. 1925.
4. STERN, CURT. *The Principles of Human Genetics.* W. H. Freeman and Co. San Francisco. 1949.



About Time Department

Public Health Division

FEDERAL Security Administrator Oscar B. Ewing issued a warning on March 29, 1950, to shoe stores, their customers and their employees that X-ray machines used for fitting shoes may be dangerous. He called for voluntary control by shoe retailers, and urged communities to set up their own controls if such voluntary measures failed.

In making this warning public, Mr. Ewing said that it was in answer to the many requests received by the Public Health Service for guidance and advice on the use of X-ray shoe-fitting devices in retail stores.

The Public Health Service statement on which Administrator Ewing's warning is based follows:

"Inquiries coming to the Public Health Service about the use of X-ray devices in retail shoe stores originate in the knowledge that such machines are potentially dangerous and that under conditions known to prevail in many stores the dangers far outweigh any beneficial effects the machines may have in the fitting of shoes."

"Use of X-ray fitting machines is almost certain to be harmful when the machines are so constructed as to allow radiation to leak into the surrounding area, or when the machines are out of adjustment, or when the customer's feet are exposed to radiation a number of times in the course of numerous fittings. Children are more likely to be harmed than adults, since rapidly growing tissue is especially susceptible to damage from radiation. If there is radiation leakage, clerks and others

who spend considerable periods of time in the immediate area of the machines are endangered."

"A number of community-wide surveys have been made to determine the amount of radiation exposure involved in the fitting of shoes with the aid of X-ray machines under normal store practices. A large percentage of the machines tested in these studies produced far more radiation than is generally accepted as 'safe'. The danger from such machines—to the operators, the customers, and others—is an ever-present one. It is a danger, moreover which increases in direct proportion to the amount of time the machines are in use.

"Since the need for examination by X-ray in the fitting of shoes—except, possibly in cases of malformation—has not been proven, it is the view of the Public Health Service that the use of X-ray shoe-fitting machines should be strictly limited by stores which have such equipment or, if necessary by local regulation. In cases of malformation, it is assumed that professional advice would be sought."

"Merchants using X-ray shoe-fitting machines should be apprised of the dangers to their customers and employees should make sure, first, that the machines are properly shielded and adjusted, and second, that time limits for examinations are strictly observed. Such voluntary measures failing, community control measures should be instituted."

—U. S. Security Administration
News Release