56.8% to 70.2%. The average number of mice weaned per female rose in the same period from 3.69 to 4.08.

Handling of Wild Mice. All of the mice seen thus far in our colony have been as active and agile as the captured foundation stock. Special measures are necessary for handling them, for it is impossible to open a cage without having many escape. The simplest practical expedient is to perform all manipulations of the mice in a large box 18 to 20″ deep with smooth sides. The escaping mice are thus confined to the larger box and may be recaught. With a little practice all of the ordinary manipulations of a mouse colony may be carried out quite easily.

Summary. The establishment of a breeding colony of wild house mice has been described. The inclusion of exercise drums in the breeding cages was found to be necessary.

15535 P

Effect of Oxygen on *P. lophurae* Infected Ducks.*

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It has been suggested that anoxia is an important factor in the mechanism of death in acute *P. falciparum* infection in man,[1] *P. knowlsi* infection in monkeys[2] and *P. lophurae* infection in ducks.[3] Furthermore it has been shown that ducks with malaria die sooner when placed in a decompression chamber than control birds kept at normal atmospheric pressure.[4] With the rapid destruction of red cells by the parasites the time may come during this disease when there is an insufficient number of red cells to carry a sufficient quantity of oxygen to supply the tissues of the host. The frequent intravenous injection of large quantities of duck red blood cells into birds that are moribund from malaria definitely prolongs their life.[5] In this study young ducks infected with *P. lophurae* have been placed in a chamber and given oxygen to determine its effect on the course of the infection.

In one experiment 10 ducks 15 days of age were inoculated intravenously with *P. lophurae* and put into the oxygen chamber. The oxygen within the tank was kept at approximately 50% concentration for 6 days at which time the amount of oxygen was increased to 75-85% for one day. Twenty similarly infected ducks were kept in batteries in the animal room. The time that death occurred in these 2 groups of ducks is shown in Experiment 1, Table I. A second group of 25 ducks 18 days of age were inoculated intravenously with *P. lophurae* infected blood. On the 4th day of the infection 10 of these were put into the oxygen chamber. The concentration of oxygen was kept at approximately 50% for 18 hours and then increased to 75% and ultimately to 85% during the following 24 hours. The 15 ducks in the control group were kept in the battery in the animal room. The time at which these birds died is shown in Experiment 2, Table I. In the third experiment 20 ducks 18 days of age were put into the oxygen chamber on the 4th day of

* This work was supported by a grant from the John and Mary R. Markle Foundation to the Department of Pathology. The oxygen was supplied by The Linde Air Products Company.

Research Paper No. 599, Journal Series, University of Arkansas.

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TABLE I.
Effect of Oxygen on *P. lophurae* Infected Ducks.

	No. of ducks in each experiment No. of ducks dead					
	Exp. 1		Exp. 2		Exp. 3	
Time	10 ducks oxygen	20 ducks control	10 ducks oxygen	15 ducks control	20 ducks oxygen	21 ducks control
5th Day—						
8 a.m.					0	1
12			0	2	0	3
4 p.m.			0	5	0	7
8			2	10	4	12
12			5	11	5	13
6th Day—						
4 a.m.			7	11	5	13
8	1	7	8	12	7	16
12	2	11	8†	12†	10	18
4 p.m.	3	15			10	18
8	3	15			10	18
12	5	15			10	18
7th Day—						
8 a.m.	7	15			12	18
12	8*	15*			13‡	18‡

* Experiment discontinued, 2 ducks survived given oxygen, 5 of the controls survived.
† " " 2 " " " " 3 " " " "
‡ " " 7 " " " " 3 " " " "

infection and 21 were kept in the battery. The oxygen concentration was kept at approximately 50% for 24 hours after which it was increased to 85-90% for the following 2 days at which time the experiment was discontinued. The time that death occurred in these 2 groups of ducks is shown in Experiment 3, Table I. The data given in Table I indicate that ducks infected with *P. lophurae* survive for a longer period when kept in an oxygen chamber containing 75 to 90% oxygen than similarly infected birds kept in batteries in the animal room.

The degree of parasitemia was followed in some of these infected ducks by counting the number of parasitized cells per 500 R.B.C. in the peripheral blood. Smears were stained with a combination of Wright's and Geimsa's stains. Our results indicate that the parasitemia is higher at the time of the peak of the infection in the birds kept in the presence of the high concentration of oxygen than it is in the control groups kept in the batteries. The total red cell counts were followed in a group of 6 young ducks kept in the oxygen chamber for 2 weeks with a concentration of approximately 50 to 75% of oxygen. These birds showed only a slight decrease in the total red cell count after being in the chamber for 5 days. The number of cells then gradually increased during a period of 48 hours and remained at a level slightly below normal for 6 days. After 2 weeks these birds were removed from the tanks and put into the regular batteries. There was no significant change in the red cell count during the following 6 days. Seven normal ducks 16 days of age were put into the chamber with an oxygen concentration of approximately 50%. After 2 days the blood from one of these birds was removed by cardiac puncture. The color index, volume index and relative cellular hemoglobin were determined. Blood was obtained from other ducks in the tank over a period of one week. Blood for the controls was obtained from similar aged birds kept in the battery. There occurred a slight increase in the color index and a slight decrease in the relative cellular hemoglobin of the ducks kept in the oxygen chambers over that of the controls.

The ducks were kept in the oxygen chamber continuously during these experiments except for the short intervals necessary to obtain

blood for the different examinations. A few of the malarial infected birds were kept in the chamber and no smears were made. The fact that these ducks survived for a longer time when given oxygen would lend support to the opinion that anemic anoxia is a significant factor in the mechanism of death in the acute forms of malaria. The results of this study would indicate that the acute forms of this disease should be treated with a plasmodicial drug and also blood transfusions and oxygen should be given to combat the anoxemia.

Summary. It has been shown that ducks injected with *P. lophurae* survive for a longer time when placed in a chamber with 75 to 90% oxygen than the controls kept in batteries in the animal room. These observations support the opinion that anoxia is a significant factor in the mechanism of death in the acute forms of malaria.

15536

Inability of Penicillin to Neutralize Dick and Schick Toxins.

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The effect of penicillin upon the toxins of various bacteria is not as yet definitely established. Neter[1] showed that penicillin did not modify the action of tetanus toxin on mice. On the other hand, Boor and Miller[2,3] demonstrated that endotoxins obtained from meningococci and gonococci caused the death of fewer mice when the mice also received injections of penicillin. Meads and his associates,[4] as well as we,[5] have observed shortening of the course of scarlet fever in most of the patients who were treated with penicillin. The fever and toxicity diminished as soon as adequate doses of penicillin were given. As a result of these clinical observations we became interested in determining whether penicillin would neutralize the erythrogenic toxin of the hemolytic streptococcus. The experiments were later extended to include the toxin of the diphtheria bacillus. The results of these investigations are reported in the present paper.

Methods and Materials. One-tenth cubic centimeter of sodium penicillin in concentrations ranging from 10 to 1000 units per cc of isotonic salt solution were mixed with 0.9 cc of standard Dick or Schick toxins. In some instances the mixtures were injected immediately and in others they were first incubated for 4 or for 24 hours. The 2 controls used with each test were: (a) the same concentration of penicillin as that in the test dose, and (b) the standard toxins, diluted in salt solution to 90% of their usual strengths. Whenever the test mixtures were incubated prior to injection, the control materials were incubated for the same period of time. The skin reactions to Dick toxin were read 24 hours after intracutaneous injection and the Schick tests after 48 hours. The degree of erythema, edema and induration was used as criteria for judging the results.

Results. Dick Tests. Altogether 67 tests with mixtures of penicillin and Dick toxin were done on 63 subjects. The results are shown in Table I. The control tests containing penicillin in salt solution gave nega-

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