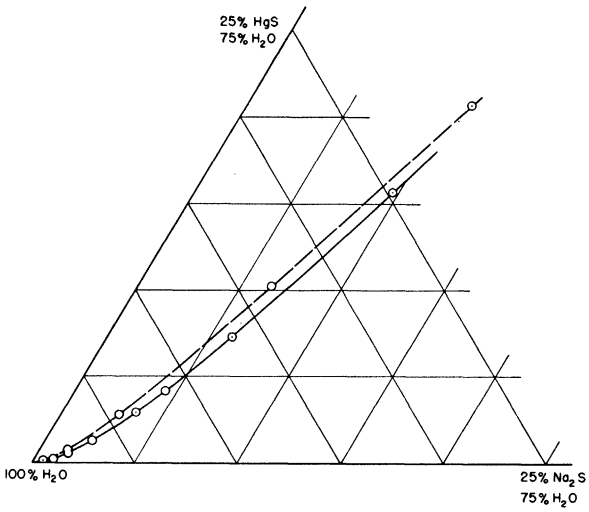

FIG. 1. The saturation curves of cinnabar and metacinnabar in the system HgS–Na_2S–H_2O at 25° C from the H_2O corner to points beyond the line H_2O-equals-75-percent-by-weight. The dashed line represents the saturation curve of metacinnabar; the solid line, the saturation curve of cinnabar. The small circles represent analyses of saturated solutions.

weight are shown in Fig. 1. The analyses of the solutions saturated with cinnabar and with metacinnabar at 25° C are represented by small circles in this figure.

Previous work by Knox (*1*) had shown that in Na_2S solutions there is a marked increase of solubility of cinnabar and metacinnabar with increasing concentration of Na_2S. Knox determined the concentrations of HgS in the saturated solutions in grams per cubic centimeter, and his data were therefore insufficient to determine the exact positions of the saturation curves in a triangular equilibrium diagram.

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Effect of Cortisone on Experimental Murine Typhus in Mice[1]

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Studies concerning the effect of cortisone and other adrenal cortical hormones on infectious diseases have attracted considerable attention during the past few years. Cortical hormones have been shown to increase the susceptibility in a number of hosts to many unrelated bacterial and viral diseases (*1*). Owing to the lack of a highly susceptible animal for studying experimental infections with typhus rickettsiae, the possibility that cortisone might enhance the susceptibility of mice to murine typhus seemed worthy of invesigation.

The inoculum used in these experiments consisted of yolk-sac material infected with *Rickettsia mooseri*. Heavily infected yolk sacs harvested from viable chick embryos were diluted to 10 percent by weight with 0.5 percent sterile skim milk and ground in a sterile cold Waring Blendor for 10 sec. Immediately prior to inoculations for infectivity titrations, the inoculum was titrated by the mouse toxicity test (*2*) to provide information on the relative potency of the inoculum used for each experiment. Twofold dilutions (1 : 10 to 1 : 10,240) were inoculated intraperitoneally in 0.5-ml amounts in the infectivity tests.

Four strains of mice were tested: albino, C strain, NHF_8 (*3*), and dba mice, which ranged in weight from 15 to 22 g (*4*). The cortisone was injected subcutaneously in 0.2-ml doses (*5*).

TABLE 1. Effect of cortisone on the susceptibility of various strains of mice to murine typhus.

Cortisone dosage (mg)	Strain of mice infectious LD_{50}					
	White*	C*	White*	NHF_8*	White†	Dba†
1.25	1280	2580	1280	4190	1600	1280
2.5					3900	2560
5.0					< 5120	10240
0.0	185	690	185	115	240	200

* Toxic dose 1 : 50.
† Toxis dose 1 : 65.

To determine the effects of varying dosage of cortisone on their susceptibility, white mice were given 0.625, 1.25, 2.5, 5.0, and 10.0 mg cortisone 4 hr prior to injection of the infectious suspension. No adverse effects of cortisone treatment were evident in control mice when 5.0 mg or less was used, whereas 10.0 mg produced several deaths on the 7th and 8th days after inoculation. Mice were observed for a period of 10 days. By using an inoculum with a toxic LD_{50} of 1 : 130, the following infectious LD_{50}s (*6*) were obtained: mice receiving no cortisone, 1 : 250; 0.625 mg, 1 : 1280; 1.25 mg, < 1 : 2560; 2.5 mg, 1 : 1750; and 5.0 mg, 1 : 1500. The results of this experiment indicated that the use of as little as one pretreatment of 0.625 mg greatly increased the susceptibility of white mice to murine typhus infections.

To determine the best time to administer the cortisone relative to the injection of infectious material, white mice were given a single dose of 1.25 mg of cortisone at 0, 4, 7, 16, 20, and 24 hr prior to infection and 24 hr after infection. The maximum effectiveness of 1.25 mg of cortisone was reached 4 to 16 hr after it was administered subcutaneously. The period of maximum effectiveness of other dosages of cortisone given subcutaneously to mice was not determined. Using an inoculum with a toxic LD_{50} of 1 : 14, the

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following infectivity LD_{50}s were obtained: no cortisone, 1 : 30, 0 hr, 1 : 65; 4 hr, 1 : 230; 7 hr, 1 : 220; 16 hr, 1 : 205; 20 hr, 1 : 70; 24 hr prior, 1 : 70; and 24 hr after, 1 : 190.

The results presented here demonstrate quite readily that cortisone greatly increases the susceptibility of white mice to murine typhus. In Table 1, evidence is presented concerning the effect of cortisone on infection in other strains of mice as compared with white mice. Cortisone-treated white mice were found to be 7 times as susceptible as untreated mice. The susceptibility of NHF_8 mice was increased more than 40 times. Cortisone treatment of the C strain, which was routinely more susceptible than the white mice, showed an increase of only a little more than 4 times that of the untreated mice. The effects of cortisone on the dba mice seemed to be approximately equal to those on white mice when 1.25 or 2.5 mg was administered. Although the titration with white mice is not complete, 5 mg appeared to have a greater effect on the dba mice than on the white mice. With the 1 : 5120 inoculum, the average day of death (ADD) for white mice was 9.25, whereas for the dba it was 5.0.

Jackson and Smadel (*9*) reported that 0.1 to 1.25 mg cortisone administered over 2.5 days had no effect on the susceptibility of mice to toxins of *Rickettsia tsutsugamushi, Rickettsia prowazeki,* or *Salmonella typhosa.* We have found that there is little or no effect on the susceptibility to toxin of *R. mooseri* where 1.25 to 2.5 mg of cortisone was administered 4 to 12 hr prior to titration. White mice receiving 2.5 mg 4 hr prior to toxic titration gave a toxic LD_{50} of 1 : 80, while controls gave 1 : 50. When 1.25 mg was given 12 hr prior to toxic titration, the following toxic LD_{50}s were obtained: white mice, untreated and treated, respectively, 1 : 90, 1 : 65; dba mice, untreated and treated, respectively, 1 : 90, 1 : 145.

Cortisone treatment of mice seems, therefore, to enhance the susceptibility of this animal to infection with *R. mooseri,* and the presence of smaller numbers of rickettsiae is indicated by death of mice following injection of infectious material. With the use of cortisone-treated animals, it seems possible that a more rapid diagnostic method could be developed and that experimental typhus infections could be more readily studied.

Smaller numbers of rickettsiae caused death of NHF_8 and dba mice than of white mice after cortisone treatment. This would indicate that the use of these strains of mice would be valuable in studies using *R. mooseri.*

References and Notes

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Preparation of Isotopic Lithium Metal by Thermochemical Reduction[1]

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In conjunction with the portion of the program of the Stable Isotope Research and Production Division of the Oak Ridge National Laboratory dealing with the measurements of physical properties of isotopes and their compounds (*1*), small quantities of lithium metal were needed. Since the commercial techniques apparently are suitable only for quantities of 10 lb of salt or more and, thus, could not be used for the small isotopic amounts of the order of 0.5 to several grams, it became necessary to investigate other possible small-scale methods.

Preliminary work with miniature electrolytic cells of our own design showed them to be usable; but, both because of the holdup and because of the longer time required to carry out reduction, an electrolytic procedure was still somewhat less satisfactory than had been desired. Hence, the work turned toward thermochemical possibilities.

Earlier investigators had tried various reducing agents under different conditions, as is indicated in Table 1; but, with the exception of some of the vacuum metallurgical processes involving the reactions of oxy-compounds of lithium with aluminum, silicon, or ferrosilicon, the procedures were not very satisfactory. We found that the $FeSi_6$-LiOH-CaO reaction of the National Research Corporation gave a satisfactory product, but we objected to the necessary high vacuum and high temperature.

TABLE 1. Previous investigations.

Year	Investigator	Thermochemical reaction
1857	Troost (*2*)	$Na + LiCl$
1896	Warren (*3*)	$Mg + LiOH$
1913	Hackspill (*4*)	$Ca + LiCl$
1943	National Research Corp. (*5*)	$Fe + Li_2CO_3$
1944	National Research Corp.	$FeSi_6 + CaO + LiOH$ (or Li_2CO_3)
1947	Kroll and Schlechten (*6*)	Al(or Si) + $CaO + Li_2O$
1947	Stauffer (*7*)	$FeSi_6$(or Al-Si alloy) + Li_2O

The work of Jellinek and Czerwinski (*8*) dealing with the equilibria of the system Ba-LiCl-Li-$BaCl_2$ suggested barium as a possible reducing agent for obtaining lithium from lithium chloride. Some exploratory work in our laboratory showed that the reaction was suitable; and, subsequently, the following procedure for producing and handling lithium metal was developed.

[1] This paper is based on work performed for the AEC by Carbide and Carbon Chemicals Co., a division of Union Carbide and Carbon Corp., at the Oak Ridge National Laboratory.