darsen in that all became negative for spirochetes after the second injection and remained free during the period of observation. Two of 15 died within 19 days. This was the only group that showed no residual infections as shown by animal inoculations.

Three procedures were utilized for confirming the results of treatment: sub-inoculation into test hamsters, examination of brain tissue by Steiner's method[§] and culture on developing eggs after the method of Oag[11] and Bohls, *et al.*[12, ¶] The results of these follow-up studies showed that 9 of the 30 hamsters treated with neoarsphenamine retained viable spirochetes in the brain as revealed by animal inoculations, while only 3 residual infections were found by this test in 30 animals after treatment with trisodarsen. Eight of 15 untreated hamsters showed residual infection by animal inoculations.

Summary. An infection with a California strain of relapsing fever spirochetes was established in Chinese hamsters which responded more satisfactorily to trisodarsen than to neoarsphenamine.

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Low Temperature and Radiosensitivity of Skin of New-Born Rats. II. Resistance at Different Dosages.*

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In a previous paper[1] it has been reported that lowering the temperature of new-born rats during irradiation (1,300 r) decreased

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11 Oag, R. K., *J. Path. and Bact.*, 1939, **49**, 339.

12 Bohls, S. W., Irons, J. V., and De Shazo, T., PROC. SOC. EXP. BIOL. AND MED., 1940, **45**, 375.

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1 Evans, T. C., *J. Roentgenol. and Rad. Ther.*, in press.

the amount of injury produced in the skin. It was the purpose of this investigation to determine the amount of this resistance in terms of dosage, and to determine whether or not the resistance would be evident at high as well as at low dosages.

A series of one-day rats (albino—Wistar strain) was irradiated with dosages from 300 to 3000 roentgens in steps of 300 r. For each rat irradiated at room temperature (24-32°C), a litter-mate was treated while packed in snow or crushed ice. Each animal was taped, ventral surface up, under a 5x9 mm port in a sheet of lead which was 2 mm thick. The radiation (half value layer of ca. 2 mm al.) was unfiltered except for 2 mm of cardboard, and the intensity was usually 134 roentgens per minute. The animals were placed with the mother after the irradiation and were examined 2 weeks later. Transverse sections were made of irradiated and control regions of both ventral and dorsal skins, and the extent of injury determined. The changes noted were (1) desquamation, (2) epilation, (3) epidermal injury and (4) fibrosis. Four degrees of injury could be recognized in each of the above changes. In order to obtain a quantitative measure of injury, each degree of injury was arbitrarily given a value of 1 unit so that the maximum injury in a given section of skin would be 16 units. The region showing the greatest injury was selected for each skin, and the number of units of injury was determined. The value obtained for the ventral skin was added to that of the dorsal skin so that a maximum total injury of 32 was possible for each animal irradiated. By determining the extent of injury in these arbitrary units the writers were able to obtain a dose-effect curve for room temperature (Curve 1, Fig. 1) and another for the animals irradiated at the low temperature (Curve 2, Fig. 1). The vertical lines drawn through the experimental points represent the standard error of the mean of several determinations on the same slides. The determinations were made by 4 individuals and were made at 3 different times. The determined values for injury appear to have a linear relationship to dosage. These curves are not intended to show the absolute relation between dosage and injury but to serve as a basis for comparing the effects of similar dosages given under the two conditions.

It can be seen, by comparing the slopes of curves *1* and *2* of Fig. 1 that the injury increases more rapidly with dosage at room temperature than at low temperature. It is also to be noted that the threshold dosage is much higher for the low temperature curve than for that at room temperature. It is possible to express the increase in resistance of the animals irradiated at the low temperature in

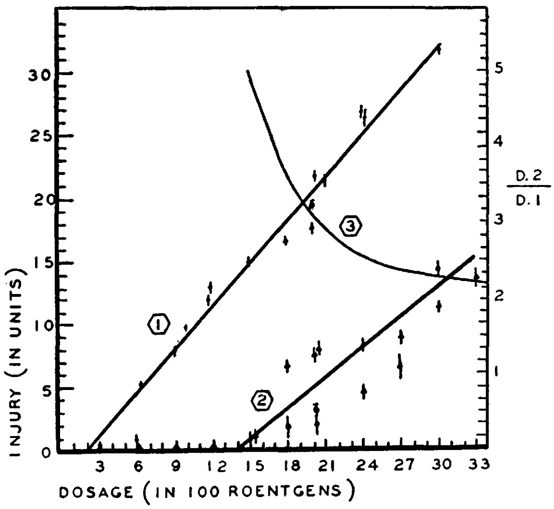

FIG. 1.

Curve 1 is a line drawn, by observation, through determinations of injury produced by irradiating the new-born rats at room temperature (24-32°C). Curve 2 is the result of the same procedure for animals irradiated at low temperature (0-8°C). The ratio of the dosage at low temperature to the dosage at room temperature required to produce the same amount of injury is shown in Curve 3.

roentgens by determining the dosage necessary under the 2 conditions to produce the same degree of injury. For example, a dosage of 2400 roentgens at low temperature gives an injury value of 8 units, and this same amount of injury is produced by only 900 roentgens at room temperature. Therefore, the low-temperature animals at this dosage may be said to be 1500 roentgens more resistant than those treated at room temperature. This difference increases with dosage from 1200 r (at a dosage of 1500 r—cold) to 1700 r (at a dosage of 3300 r—cold). The ratio of the dosage necessary to produce a certain degree of injury in low-temperature animals to the dosage which produces the same amount of injury in room-temperature animals is shown in curve *3*. It can be seen that the ratio decreases rapidly at first and then more slowly as the dosage is increased.

Conclusions. Lowering the temperature of new-born rats during irradiation increased the resistance of the skin so that a dosage increase of 1200-1700 r was required to produce an injury comparable to that of animals rayed at room temperature. The ratio of dosage required at low temperature to the dosage at room temperature decreases from 5 (at 1500 r—cold) to 2.2 (3300 r—cold).