

TT67-61195

AD 648009

INFLUENCE OF THE FUNCTION OF THE THYROID GLAND ON THE  
SUSCEPTIBILITY OF WHITE RATS TO PLAGUE INFECTION

TRANSLATION NO. 1244

December 1964

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MAR 13 1967  
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U. S. ARMY  
BIOLOGICAL CENTER  
Fort Detrick, Frederick, Maryland

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INFLUENCE OF THE FUNCTION OF THE THYROID GLAND ON THE  
SUSCEPTIBILITY OF WHITE RATS TO PLAGUE INFECTION

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[Following is a translation of an article by G. G. Korobkov in the Russian-language periodical Izvestiya Irkutskogo gosudarstvennogo nauchnoissledovatel'skogo protivochumnogo instituta Sibiri i Dal'nego Vostoka (News of the Irkutsk State Scientific Research Anti-Plague Institute of Siberia and the Far East), Vol 25, 1963, pages 148-150.]

The thyroid gland is of great importance in the regulation of the physiological functions of the organism.

The functional condition of the thyroid gland to a large degree determines the reactivity of the organism and its sensitivity to infection.

According to the data of Karnik, Cope, Marbe, Bochkarev, and Chernozatonskaya (cited by N. B. Medvedeva, 1946), lowering of the functioning of the thyroid gland is accompanied by a lowering of the level of antibodies and a decrease in the titer of the complement, which is an indicator of the lowering of the immunological reactivity of the organism. However, Locattello, Melnik (cited by N. B. Medvedeva, 1946), Sechi, and Spinelli (cited by P. F. Zdrodovskiy, 1950) showed that in animals with a lowered functioning of the thyroid gland there is an increase in the resistance to infection by dysentery and typhoid fever and also to dysentery and diphtheria intoxication. On the other hand, an increase in the functioning of the thyroid gland is accompanied by an increase in immunological reactivity, the level of antibodies, and the titer of the complement. In animals with increased functioning of the thyroid gland some infections (typhoid fever, dysentery) are more severe; however, such animals can bear tuberculosis more easily.

Sure and Buchanan and Sure and Theis (cited by P. F. Zdrodovskiy, 1950) link the increase in the sensitivity of the organism of animals to

certain infectious processes with the increased functioning of the thyroid gland and with endogenous avitaminoses C and B<sub>1</sub>, the occurrence of which depends on a considerable increase in the level of exchange processes during hyperthyroidism.

We did not find any works in which the connection of the sensitivity of the organism to plague infection with the functional condition of the thyroid gland was examined. There is the data of A. G. Kratinov *et al.* to the effect that in the little marmot during different seasons there is a different level of the functioning of the thyroid gland: for the spring season an increase in the activity of the thyroid gland is characteristic; for the fall a lowering is characteristic. It is also known that usually in the spring the animals are more sensitive to infection with plague than in the fall.

The present investigation is devoted to establishing the relation between the functioning of the thyroid gland and the receptivity of white rats to plague. An increase in the functioning of the thyroid gland (first series of tests) was caused in white rats by administering thyroidine to them orally. In order to lower the functioning of the thyroid gland (second series of tests) the animals were given methylthiouracil. The evaluation of the sensitivity of the animals to plague infection was based on the number of animals which survived since it could not be excluded that the white rats from which a culture was not isolated did die from the plague.

In the first series of tests (increase in the functioning of the thyroid gland) the animals were given 100 mg of thyroidine daily with food for 10 days.

In the second series of tests the effect of lowered functioning of the thyroid gland on the receptivity of animals with respect to plague was studied.

In these tests the lowering of the functioning of the thyroid gland in white rats was achieved through the introduction with food of methylthiouracil which was introduced daily at a rate of 10 mg over the course of 30 days.

The criterion of the functional state of the thyroid gland was the level of metabolism. The latter was determined in the rats through gas analysis. For this a special mask was used with which it was possible to determine in the rats for a given length of time the volume of exhaled air. Subsequent analysis of this air in a Haldane apparatus made it possible to establish the amount of oxygen which had been consumed and the magnitude of the exchange of substances in the rats. Under the influence of the introduction of thyroidine the metabolism increased in white rats by an average of 60%. In healthy rats of the same weight and sex for 1 kg of weight of the animal the exchange of substances amounts to (M<sub>24</sub>) 278±17 calories; for the test white rats it is 446±15.

The white rats were infected with 20,000 microbe cells of strain B. pestis 1435, which corresponds approximately to Dlm for white rats. The infecting of the animals with plague and the dissection of the animals which died were performed by G. P. Aparin.

For the test 50 white rats received thyroidine and a like number was used for control purposes. Of the test animals 86% died after infection, including 70% from plague; 14% survived; of the control animals 66% died, including 42.5% from plague; 34% survived.

Judging by the number which survived, the introduction of thyroidine caused an increase in the sensitivity of the animals with respect to infection with plague.

N. I. Kalabukhov in a series of investigations shows the presence of a connection between the level of the consumption of oxygen and the sensitivity of the rodents to plague infection: the higher the consumption of oxygen in a given animal, the easier it is infected with plague.

It can be assumed that the relation which was discovered by N. I. Kalabukhov between the consumption of oxygen and the resistance of the animals to infection with plague is to some degree related to the increased functioning of the thyroid gland in the test specimens.

In the second series of tests on animals with a lowered functioning of the thyroid gland under the influence of methylthiouracil the level of the metabolism was lowered by an average of 35%. In the test animals the magnitude of the exchange was equal to 156217 (Kcal); in the healthy (control) rats it was 224225 calories.

These animals were infected subcutaneously with plague by 20,000 microbe cells of strain 1435. Of 49 animals 67% died, including 63% from plague; 33% survived.

For control healthy rats were used which were infected with the plague in the same dosage as the test animals. Of the 50 animals 62% died, including 60% from the plague; 38% survived.

From this data it is apparent that the lowering of the functioning of the thyroid gland does not change the resistance of the test animals to the plague.

#### Conclusions

1. Upon an increase in the functioning of the thyroid gland there is a lowering of the resistance of white rats to infection by the plague.

2. Upon a lowering of the functioning of the thyroid gland no change was noted in their resistance to infection by the plague.

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