Several heterologous sera were also investigated. Non related sera were not able to neutralize the factors (Shiga, Scarlet fever, Erysipelas sera). Sera closely allied to *B. typhosus* sera (Para A and B) neutralized these factors in various proportions. The reactions also divided themselves into the same 3 types as described above (C.N., P.N. and N.N.). It is not known as yet whether the neutralization is a group reaction or the skin preparatory factors are identical with those of *B. typhosus*. It will be necessary to titrate a large number of various batches of sera in order to bring out the possible quantitative differences in the titers.

It appears from these studies that a new method is available for quantitative titration of substances in the serum which neutralize the skin preparatory factors of the phenomenon of local skin reactivity to *B. typhosus* culture filtrates. Emphasis should be laid on the fact that it is possible to control the individual susceptibility of rabbits to this phenomenon. This fact permits of considerable accuracy in quantitative titration of the sera. Attempts are under way to determine whether the proposed method can be applied to production of therapeutic sera.

Work is also in progress to determine the effect of specific sera upon the skin reacting factors introduced by the intravenous route.

4178

Stability of Luminous Substances of Luminous Animals.

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It is about ten years (1918) since I first collected the luminous ostracod crustacean, *Cypridina,* extracted the luminous materials, luciferin and luciferase, and set some of the extracts aside for later testing as to stability. The animals are collected and dried quickly over $CaCl_2$. When powdered and moistened a bright bluish luminescence appears which is as intense with the 1918 material tested in 1928 as it was in 1918. This powder contains both luciferin and luciferase and light results from mixing the 2 substances in water containing oxygen. Luciferin solution is obtained by making a hot water extract of *Cypridina.* Heating destroys the luciferase, which can be extracted from *Cypridina* with cold water. The luciferin, which dissolves at the same time, is allowed to oxidize in the air, leaving luciferase alone in solution.

Sterile luciferin extracts made in 1918 and kept under a 3 inch layer of vaselin, to prevent oxidation, gave a good luminescence when luciferase was added to them in 1928. So long as oxidation is prevented, luciferin in water solution appears perfectly stable. A flask of luciferin solution was evacuated and the glass sealed. This flask was then heated in a water bath at 100° C. for one hour and set aside, sealed, January 22, 1924. On October 16, 1928 the flask was opened to the air. No luminescence appeared on opening, but when luciferase was added, a brilliant light appeared. Evidently boiling does not destroy luciferin if air is absent. Absolute alcohol extracts of luciferin kept in air show no luminescence after a few weeks when mixed in small quantity with luciferase solution. A slow oxidation of luciferin must take place.

Luciferase solution cannot be heat sterilized and if allowed to stand unsterilized, undergoes putrefaction and the luciferase disappears after a few weeks. A solution preserved with chloroform retains the power to luminesce when mixed with luciferin for several months but the luciferase gradually disappears and a sample 10 years old gave no luminescence with luciferin. Preserved with saturated NaCl, luciferase also gradually deteriorates, but a sample over 10 years old gave a faint luminescence with luciferin. On the other hand luciferase precipitated from solution with alcohol, the precipitate dried and kept over $CaCl_2$ for 10 years, gave a good luminescence when mixed with luciferin solution.

I conclude that dry luciferin and luciferase can be kept unharmed for long periods and that an aqueous luciferin solution is also stable in absence of oxygen, but that luciferase undergoes destructive changes in water solution.

4179

On Hemagglutination by Tumor Extracts.

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A report was made years ago on a distinct agglutinating action of extracts of tumors, of human and animal origin, on rabbit erythrocytes.[1] The question was raised whether the active substance might possibly be related to growth stimulating principles.

[1] Landsteiner, K., *Wien. klin. Wochenschr.*, 1908, S. 1549.