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Sulphate Reducing Bacteria in California Oil Waters.

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Edson S. Bastin has recently pointed out[1] that certain bacteria are responsible for the fact that oil well waters are low in sulphates and high in carbonates when compared with the sources from which these waters are presumably derived. He was able to isolate bacteria producing such chemical reactions from Illinois oil field waters. He also sampled oil-well waters originating from the Sunset-Midway and Coalinga districts in California. The samples were cultured by us and we were able to isolate from them sulphate reducing anaerobic bacteria of the same type as had been found in the Illinois oil field waters. Not all the wells, however, showed evidence of these organisms. The methods used for culturing will be described in another paper.

As the temperature and salt concentration range at which the organisms metabolize have been used by former investigators[2, 3, 4] to differentiate between various types, these influences were studied. All the organisms cultured were found to grow at room temperature and up to 37° C. Only some of them (4 out of 12) grew at 50° C. According to their preferences for certain salt concentrations the following groups were distinguished:

Type 1. Growth only in media without or with less than one per cent NaCl. Represented by 2 cultures only.

Type 2. Growth only in media containing NaCl. The organisms of this type seem also to be sensitive to high concentrations of salt, 3 per cent being the upper limit at which growth was obtained. This type is represented by 2 cultures only.

Type 3. Growth both in media with and without NaCl. Some of the cultures grew in all concentrations between 0 and 3 per cent salt, one culture between 0 and 5 per cent. In no case was the upper salt limit below 3 per cent. This is the most common type which we encountered.

The rule applies for all cultures that they either grow in a medium without or with 1 per cent salt, and it seems possible that there is a salt concentration somewhat below 1 per cent in which all of them grow. One is tempted to conclude that the organisms in the various wells developed from an ancestry living in somewhat less than 1 per cent salt and that the various descendants adapted themselves to varying conditions.

Dark field examination disclosed in every case the presence of a small motile vibrio. Staining classified the organism as Gram negative. It seems safe to conclude that this organism which coincides with the descriptions given by Beyerinck,[2] van Delden,[3] and Elion[4] of their sulphate reducing bacteria, morphologically identical with each other, is the causative agent of the sulphate reduction.

It is not possible to fit the organisms from the various wells into the groups suggested by the Dutch investigators previously quoted. If one wanted to stick to the Dutch classification one would have to assume for instance, that some of the wells contain a mixture of Beyerinck's desulfuricans and van Delden's aestuarii, both morphologically identical with each other.

It seems far more logical to assume that the various sulphate reducing vibrios represent the same organism which adapted itself to the conditions of various surroundings and thereby succeeded to live under more extreme conditions than those under which it was studied by the original investigator, Beyerinck. If this standpoint is taken, all the cultures studied appear as variations of the original vibrio desulfuricans.

We had an opportunity, through the courtesy of E. S. Bastin, to compare the living conditions of the bacteria in culture, so far as temperature and salt concentration are concerned, with the conditions which he had encountered, when he sampled the oil wells furnishing the bacteria. It is interesting to note that the bacteria which we had found able to live at 50° C. came from a definite small area of the oil field and that the temperature of these wells was the highest recorded, being nearly 50° C.

It is also worth noting that the organisms isolated from oil wells with low sodium chloride content refused to grow in media with as low as one per cent salt. There is, therefore, a close correspondence

between the living condition observed in the field and the limiting conditions observed in the laboratory.

This is a preliminary report.

[1] Bastin, Edson S., Anderson, Belle, Green, Frank E., Merritt, C. T., and Moulton, Gail, *Bull. Am. Assn. of Petroleum Geologists*, 1926, x, 1270-1299,

[2] Beyerinck, W. M., *Centr. für Bakter.*, etc., 1895, Abt. II, i, pp. 1-9 and 104-114.

[3] van Delden, A., *Centr. für Bakter.*, etc., 1903-4, Abt. II, xi, pp. 81-94 and 113-119.

[4] Elion, H., *Centr. für Bakter.*, etc., Abt. II, lxiii, 58-67.

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The Effect of Heparin on Anaphylactic Shock in Guinea Pigs.

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Kyes and Strauser[1] have recently reported the inhibition of anaphylactic shock in pigeons by the intravenous injection of heparin 45 minutes preceding the shocking dose of antigen. They state that it is their belief that many of the symptoms of anaphylactic shock are the result of the formation of fibrin aggregates, and that if the formation of these aggregates be inhibited by a suitable reagent the symptoms will be reduced or eliminated.

In view of the striking results of these workers with pigeons, it seemed to us that it would be worth while to determine the effect of heparin on anaphylactic shock in guinea pigs. The animals were sensitized to horse serum twenty days before testing. Eight controls were tested for efficiency of sensitization, 6 of these dying with classical antemortem symptoms and showing the typical post mortem picture. Two animals exhibited symptoms of severe shock but survived. The guinea pigs receiving heparin were given 5 mg. of heparin in physiological salt solution intracardially for each 100 grams of body weight. The results obtained with these animals are shown in Table I.

As shown in the table, two of the heparinized guinea pigs receiving shocking doses of serum exhibited classical symptoms of shock, one of them succumbing with typical post mortem findings. It may be recalled that Kyes and Strauser report that 1 of 12 heparinized pigeons showed transitory symptoms. We do not feel that there is