In these experiments there were several factors which may have been responsible for these differences in growth. It was possible that the species of animal from which the serum in which the bacteria were grown was responsible. To eliminate this possibility, virulent and avirulent cultures of the same strain of streptococci have been compared in the serum of the animal for which they were rendered virulent.

Five strains of streptococci were inoculated consecutively into rats until .0001 cc. of 18 hour broth cultures killed these animals on repeated tests. Following out the technique of the previous experiments we have compared the growth and the production of hemolysin with these strains in broth enriched with rat serum. The hemolysin produced was titrated with standardized suspensions of cells obtained by defibrinating rat blood. The same results were obtained in these experiments as were found in those previously reported. The avirulent strains grew more rapidly immediately after inoculation and produced the maximum amount of homolysin earlier than the strains which had been rendered virulent for mice.

Since similar results were obtained in both series of experiments it appears that the differences in the rates of growth depend on the differences in the virulence of the strains. The experiments suggest that an analogy exists between the behavior of these strains of streptococci and saprophytic and parasitic bacteria. Saprophytes which grow readily *in vitro* resemble the less virulent cultures of streptococci, while parasitic, pathogenic bacteria which are grown with greater difficulty in media resemble the more slowly growing virulent cultures of streptococci.

## 42 (2274)

### Studies in narcosis.
### IV. A simple and rapid method for the determination of ether in blood.

By T. K. KRUSE.

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The principle of the method here described depends upon the separation of ether from blood by boiling a tannic acid blood

mixture and determining the amount of recovered ether by differential absorption in concentrated sulfuric acid. Obtaining the gas sample requires 5 minutes and the entire procedure, 15 minutes. The methods described in the literature are time consuming.[1, 2, 3]

A 30 cc. test tube is arranged in aspirator fashion. The rubber stopper is protected by a copper guard to reduce the exposure of rubber to ether vapor. Fifteen cc. of a 1 per cent tannic acid solution are put into the test tube to which 1 cc. of oxalated blood is added. The test tube is stoppered, the tube extending into the liquid is closed by means of a pinchcock and the tube extending only through the stopper is connected with a sampling tube containing concentrated calcium chloride solution covered with a generous layer of glycerol in which ether is practically insoluble. With the sampling tube under negative pressure, the blood mixture is boiled for a minute to expel all the gases dissolved in the liquid. Near the boiling point of the liquid the precipitated blood congeals and adheres to the walls of the test tube and does not interfere in any manner with the procedure. The ether which remains in the air of the test tube is very rapidly drawn into the sampler by opening the tube which extends into the liquid. It is important that this is done as rapidly as the apparatus permits to prevent the diffusion of gases. The 40 cc. sample thus obtained is transferred to the 40 cc. analyzer and the ether content determined.[4] The test tube may be readily cleaned of its sticky coagulum by washing with dilute sodium hydrate solution.

Weighed samples of unpurified ether when added to blood yielded 90 per cent or better of the theoretical value. Inasmuch as such ether is only 90 to 95 per cent pure the method is sufficiently accurate for pharmacological investigation. Blood containing no ether yielded no absorbable gas. The error of reading was 0.02 cc. but quite frequently identical readings were obtained on duplicate blood samples.

The concentrations of ether found in the blood are in harmony with those published in the literature, Table I.

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1 Nicloux, *Compt. rend. Soc. biol.*, 1906, lxi, 606.

2 Haggard, H. W., *J. Biol. Chem.*, 1923, lv, 131.

3 Shaffer, P. A., and Ronzoni, E., *J. Biol. Chem.*, 1923, lvii, 741.

4 Kruse, T. K., *J. Biol. Chem.*, 1923, lvi, 127.

TABLE I.

Protocol of Dogs Showing the Nature of Results Obtained.

| Time A. M. | Temp. °C. | Ether in 100 cc. Arterial Blood cc. | Ether in 100 cc. Arterial Blood mg. | Air cc. | Remarks. |
|---|---|---|---|---|---|
| **Dog A.** | | | | | |
| 10:45 | 39 | .... | ..... | ..... | Dog anesthetized. |
| 11:02 | 39.1 | 41 | 136 | 6.63 | Very slight corneal reflex. |
| 11:18 | 39.3 | 32 | 106 | 4.50 | Corneal reflex. |
| 11:24 | .... | .... | ..... | ..... | Ether concentration increased. |
| 11:35 | 39.6 | 38 | 126 | 7.63 | Arterial blood dark. No corneal reflex. |
| 11:46 | 39.8 | 36 | 119 | 6.06 | Arterial blood dark. No corneal reflex. |
| 11:53 | .... | .... | ..... | ..... | Ether concentration increased. |
| 12:00 M. | 39.7 | 43 | 142 | 8.67 | Respiration shallow. Arterial blood dark. No corneal reflex. |
| **Dog B.** | | | | | |
| A. M. | | | | | |
| 10:00 | 39.0 | .... | ..... | ..... | Dog anesthetized. |
| 10:48 | 39.2 | .... | ..... | 5.11 | Corneal reflex. |
| 10:56 | 39.2 | .... | ..... | 4.31 | Corneal reflex. |
| 11:04 | 39.4 | 28 | 93 | 3.40 | Corneal reflex. |
| 11:12 | .... | .... | ..... | ..... | Ether concentration increased. |
| 11:18 | 39.5 | 32 | 106 | 5.70 | Corneal reflex. |
| 11:26 | 39.6 | 31 | 103 | 4.35 | Corneal reflex. |
| 11:37 | 39.6 | 31 | 103 | 4.57 | Corneal reflex. |
| 11:52 | .... | .... | ..... | ..... | Ether concentration increased. |
| 11:57 | 39.8 | 42 | 139 | 6.92 | Quieter resp. Slight corneal reflex. |
| P. M. | | | | | |
| 12:06 | 39.9 | 32 | 106 | 6.55 | Slight corneal reflex. Arterial blood dark. |
| 12:18 | 40.0 | 31 | 103 | 5.38 | Corneal reflex. |

## 43 (2275)

## The absorption of digitalis from the rectum in man.

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Not infrequently, patients suffering from heart failure are unable to take digitalis by mouth because of nausea, vomiting or surgical operation. The margin of safety between therapeu-