*Summary.* A careful repetition of Rowntree's experiment in which ether extracted wheat germ oil was fed to rats failed to confirm his claim that intraperitoneal sarcomas can be induced in this manner.

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## Action of a Quaternary Ammonium Type of Wetting Agent on Metabolism of Microörganisms Associated with Dental Caries.

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In the search for a compound which can effectively inhibit the metabolism of microörganisms found in lesions of dental caries, or in plaques associated with such lesions, we have studied the action of alkyl dimethyl benzyl ammonium chloride (Zephiran*) on these bacteria. The germicidal action of this compound was described by G. Domagh.[1]

Pure cultures of 5 microörganisms, which are found constantly or very frequently in association with human dental caries, were studied. These were a lactobacillus, 2 strains of *M. tetragenus, Staphylococcus albus,* an unidentified, aerobic, acid-producing, Gram-positive diplococcus and a yeast of the genus Monilia. Washed suspensions of the organisms were placed in appropriate buffers containing 0.02M glucose, and their rate of respiration or glycolysis measured in Warburg vessels. The alkyl compound exerts a pronounced inhibitory effect on both respiration and glycolysis at extremely low dilutions (concentrations estimated at M/10,000 to M/50,000).† At a concentration of M/10,000 the compound exerts its full effect on one billion cells within 5 to 10 minutes. That the inhibition is complete and irreversible is demonstrated by the following experiment: organisms which were exposed to the compound for several minutes, and then centrifuged off and washed with

* The authors are indebted to the Alba Pharmaceutical Company for the Zephiran compound employed in this study.

1 Domagh, G., *Deutsche Med. Wochenschr.*, 1935, **61**, 829.

† The molecular weight of the alkyl dimethyl benzyl ammonium chloride compound was approximated as 350 by taking an arithmetic average of the alkyl groups which vary from $C_8$ to $C_{18}$. The "compound" is a mixture of the quaternary ammonium derivatives of fatty acids obtained from coconut oil.

TABLE I.

| | Micrograms per $10^9$ cells | % inhibition (in 60 min) |
|---|---|---|
| *Lactobacillus sp.** | 25 | 90 |
| " | 4 | 34 |
| *M. tetragenus* (A)* | 10 | 97 |
| " (B)‡ | 2 | 90 |
| *Staphylococcus albus*‡ | 14 | 94 |
| " | 7 | 94 |
| Gram-pos. oral diplococcus* | 15 | 91 |
| *Monilia sp.* | 3000 | 89 |
| | 600 | 50 |

* Aerobic glycolysis.
‡ Respiration.

saline, did not regain their metabolic activity when resuspended in fresh glucose-buffer solution. Table I shows the extremely small quantities of the compound required to inhibit one billion cells of the particular organisms studied.

It can be seen that the alkyl dimethyl benzyl ammonium chloride has an activity comparable to that of the unusually potent compounds recently obtained by Dubos[2] from soil bacteria.

The marked inhibition of the metabolism of dental bacteria by the alkyl dimethyl benzyl ammonium chloride makes this compound of unusual interest. It has been shown by one of us[3] that fluoride and iodoacetate can retard, and in some cases prevent, the development of experimental dental caries in the rat. We have compared the action of "Zephiran" with fluoride and iodoacetate and have found it much more active in inhibiting the metabolism of dental bacteria and yeast. Because of the unusual inhibiting action of the alkyl dimethyl benzyl ammonium chloride compound, its excellent powers of penetration and cleansing, and its low toxicity for mucous membranes, this substance appears to deserve considerable study. The action of "Zephiran" on the mixed bacterial flora of the dental plaque *in vitro* and *in vivo* is also under study.

2 Dubos, R., *J. Exp. Med.*, 1939, **70**, 1.

3 Miller, B. F., PROC. SOC. EXP. BIOL. AND MED., 1938, **39**, 389.