COMMUNICATIONS TO THE EDITOR

GROWTH OF BACTERIA IN ORGANIC ACID MEDIA

Sir:

During a study of the growth of bacteria in solutions in which the sodium salt of some organic acid furnished the only source of carbon, a relationship between the number of carbon atoms in the acid and ability of the bacteria to grow in the solution has been observed. Of the non-substituted fatty acids containing from one to four carbons, those with *even* numbers of carbon atoms support growth of organisms with a graded series of nutritive requirements, but those with *odd* numbers of carbon atoms support little or no growth even by the organism which grows well in a large number of solutions of organic salts. Natural fats are derivatives of *even*-numbered fatty acids; the *even*-numbered unsubstituted straight chain compounds occur in nature much more abundantly than the odd-numbered [Hawk and Bergeim, "Practical Physiological Chemistry," P. Blakiston's Son Co., Philadelphia, Pa., 1931, p. 175]; and the simple *even*-numbered fatty acids are more readily utilized by the bacteria than the odd numbered acids.

The action of animal tissues in distinguishing between *even*- and *odd*-numbered fatty acids [H. D. Dakin, "Oxidations and Reductions in the Animal Body," Longmans, Green and Co., New York, 1922, p. 33] appears similar to the action of these bacteria; but it is still doubtful whether the theory of β-oxidation applies to the metabolic processes of the bacteria. F. Knoop ["Ahrens Sammlung," 9 n. f., 1931] states that in β-oxidation by animal tissues, β-hydroxy and β-ketonic acids behave just like the corresponding fatty acid. But growth of the organisms in β-hydroxy-*n*-butyric acid medium is either absent or faint, where for the same organisms *n*-butyric acid supports moderate or excellent growth.

Of the *substituted* fatty acids thus far studied, the *even*-numbered hydroxy acids, unlike the unsubstituted acids, all support either no growth or at most feeble growth by the most adaptable organism; but all the *odd*-numbered hydroxy acids support growth by all the organisms and a very abundant growth by the most adaptable. All the *even*-numbered amino acids support no growth or feeble growth by the most adaptable organism, and the *odd*-numbered amino acids support abundant growth. The number of these substances thus far studied is nevertheless too limited to permit generalization concerning the effect of the nature or position of the substituent groups on the ability of the bacterial enzyme systems to attack the compounds.

The particular organisms used in this study, listed in approximately the order of increasing nutritive requirements, are *B. pyocyaneus*, *B. aertrycke* (rough), *B. paratyphosus* B (rough), *B. bronchosepticus*, and *B. aertrycke* (smooth). The *odd*-numbered acids, formic, propiolic and propionic, support no growth except for faint growth by *B. pyocyaneus* in propionate medium (Kahlbaum). The *even*-numbered acids, acetic, butyric and isobutyric, support excellent growth by *B. pyocyaneus* and moderate growth by *B. aertrycke* (rough) and *B. bronchosepticus*. The *odd*-numbered hydroxy acids, lactic, glyceric and α-hydroxyacrylic, support growth by all the organisms, and for the most part very abundant growth. The *even*-numbered hydroxy acids, glycolic and β-hydroxy-*n*-butyric, support a feeble growth by *B. pyocyaneus*, and α-hydroxyisobutyric acid supports no growth. The *odd*-numbered amino acid alanine supports abundant growth by all organisms except *B. aertrycke* (smooth). The *even*-numbered amino acid glycine supports a feeble growth by *B. pyocyaneus*, and α-amino-*n*-butyric acid, likewise *even*-numbered, supports no growth.

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THE REACTION OF ETHYLENE OXIDE WITH ACETYLENIC GRIGNARD REAGENTS

Sir:

Recently Faucounau [*Compt. rend.*, **199**, 605 (1934)] described the preparation of acetylenic alcohols by the action of ethylene oxide on acetylenic Grignard reagents while more recently Danehy, Vogt and Nieuwland [THIS JOURNAL,