times and may be over ten times that from a 100 W tungsten lamp at 400 mμ for the same radiation at 540 mμ. Museum curators may find this to be of interest.

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MICROBIOLOGY

Bacterial Growth at Low Population Densities (II)

In a previous communication[1], the possible influence of low population densities on the growth of *Spirillum serpens* under steady-state conditions (lactate growth limiting) was reported. Qualitative evidence was given by the fact that the inhibition of growth at low concentrations of the limiting nutrient entering the chemostat was partly removed by lowering the concentration of dissolved O_2 or the addition of ascorbic acid to the medium. It was suggested that the reducing power of the cells becomes growth limiting in the system when the population density falls below a certain value. Additional data have been collected to substantiate this suggestion.

During the steady-state, the population density (x) is a function of the concentration of the limiting nutrient entering the chemostat (s_r): $x = y\,(s_r - s)$, where y is the yield coefficient and s the concentration of the limiting nutrient in the chemostat[2]. After direct determination of x (ref. 2) and s (with DPN and lactate dehydrogenase[3]), the decrease of growth observed in the presence of a decreasing s_r was calculated at the expense of the yield coefficient: $y = \frac{x}{s_r - s}$. The maximum growth rate (μ_{max}) and the saturation constant (K_s) were the same as given in ref. 2. The dilution rate (D) was 0·5 μ_{max}.

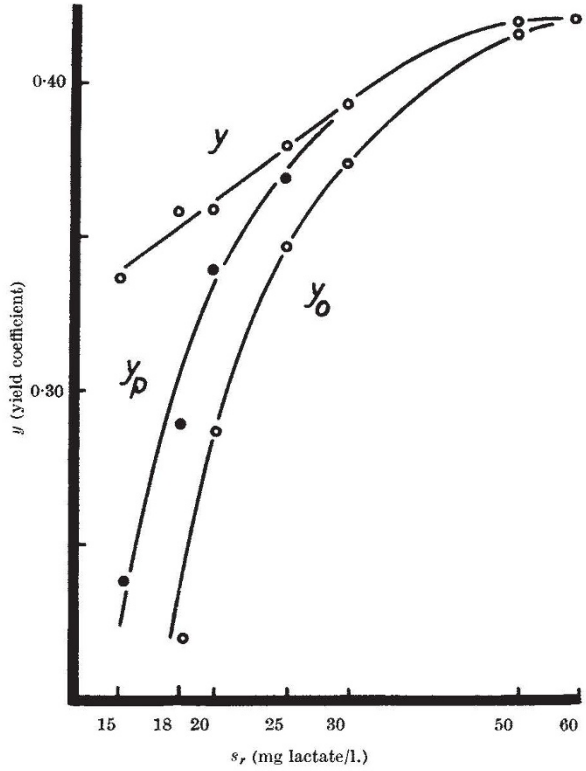

Fig. 1. Yield coefficient (y, y_0, y_p) plotted against the concentration of the growth-limiting nutrient entering a steady-state culture (chemostat) of *Spirillum serpens*

In Fig. 1, y_0 has been calculated on assumption that s stays constant at the given dilution rate ($s = 2{\cdot}2$ mg lactate/l.). Direct determination, however, showed a definite increase of s when s_r was decreasing below 50 mg lactate/l. This apparent waste of the limiting nutrient suggests an inhibiting effect upon the uptake and invalidates the definition of $s = K_s \frac{D}{\mu_{max} - D}$ (ref. 1) at low values of s_r in the present case. If the actual data of s are used in the calculation, y shows a slower decline as compared with y_0 (Fig. 1).

Repeating the experiment after the addition of 0·002 per cent ascorbic acid to the medium flowing into the chemostat, s was observed to increase more slowly. In other words, by supplying a reducing agent, the apparent waste of the limiting nutrient was partly prevented. Calculation of the yield coefficient in this case (y_p in Fig 1) gave a line almost parallel to y_0. Lowering the concentration of oxygen in the aerating gas mixture had a similar effect.

That part of the growth-inhibiting effect which is attributed to a decreasing reduction power of the population at low densities does not occur before s_r decreased below 30 mg lactate/l. The difference between the curves of y_0 and y_p demonstrates the remaining part of the growth-inhibiting effect which is not explained by a population phenomenon. In general, sub-optimal growth conditions result in a decrease of the yield coefficient at low population densities due to bacterial action on the environment. This effect is independent of a yield-affecting endogenous respiration or maintenance metabolism.

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Lysogeny in *Alcaligenes faecalis* and the Host-range of *A. faecalis* Bacteriophages

Eighty-six strains of *Alcaligenes faecalis* were investigated. Five of these were N.C.T.C. cultures. The remaining strains were isolated from fæces and correspond to the description in Bergey's *Manual of Determinative Bacteriology*[1]. Media adopted were those previously[2] used. Lysogeny was investigated by growing organisms singly and in mixtures in broth for 10 days and by ultra-violet induction. These methods have been described[2]. Thirty of the organisms proved lysogenic for one or more of the 86 strains. Thirteen strains were inducible by ultra-violet light. Moore and Pickett[3] investigated 40 strains of *A. faecalis*-like organisms and found 3 of them to be lysogenic for other members of the group.

Attempts were made to isolate phages active on *A. faecalis* from sewage by the enrichment technique of Adams[4]. Twenty-three phages were isolated in this manner. Phages were purified by repeated single plaque isolations. Lysates were stable when stored above 0·1 vol. of chloroform.

The host ranges of the 53 phages were investigated by spotting drops of lysates (plaque-forming titres about 10^8/ml.) on freshly poured lawns of the 86 strains of