AN INTERPRETATION OF BACTERIAL GROWTH-RATE CURVES.

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(With 2 Graphs in the Text.)

The usual graphical method of expressing the increase of bacterial growth rate in a media by means of the bacterial number/time curve, has several disadvantages, inasmuch as that the maximum growth rate cannot be accurately determined, nor the period of optimum propagation. An improved method of presenting a bacterial growth-rate curve and eliminating the aforementioned disadvantages will now be described, and the new types of curves illustrated.

A need for this new method was felt while working on the new photo-electric method of interpreting growth rate by density measurements[1].

A perfect growth rate curve indicating bacterial increase in numbers per time of incubation usually evolves a sigmoid logarithmic curve, neglecting precipitation, death of bacterial organisms, etc. This curve, while indicating the total number of organisms at any given time, fails in not accurately indicating the period of incubation at which the organisms are most rapidly propagating.

For all kinds of bacterial organisms the sigmoid curve is usually evaluated, while the new type of curve is comparatively distinctive, approximately indicating by the shape of the curve, the organism; the initial amount of inoculum also introduces an alteration in the shape of the curve.

Furthermore, the new curve admirably indicates the period at which the maximum expansion rate takes place in a bacterial colony. The new curve can easily be obtained from any sigmoid curve giving number/time of organisms or colony size/time of colonies, by utilising the formula $\frac{dN}{dt}$ for each period of time of obtaining the bacterial number or measurement of colony. If for each period of time (T) the count is N_0, N_1, N_2, ..., etc., at times t_0, t_1, t_2, ..., the following formula is used:

$$\frac{(N_1-N_0)}{(t_1-t_0)_{\frac{1}{2}(T_1)}} \text{ and } \frac{(N_2-N_1)}{(t_2-t_1)_{\frac{1}{2}(T_2-T_1)+T_1}}, \text{ etc.,}$$

and plotted on a graph whose abscissae indicate T and ordinates indicate rate of propagation a curve similar to Graph 1 will be obtained.

[1] *Journal of Hygiene,* **33,** 245–251 (April 29th, 1933).

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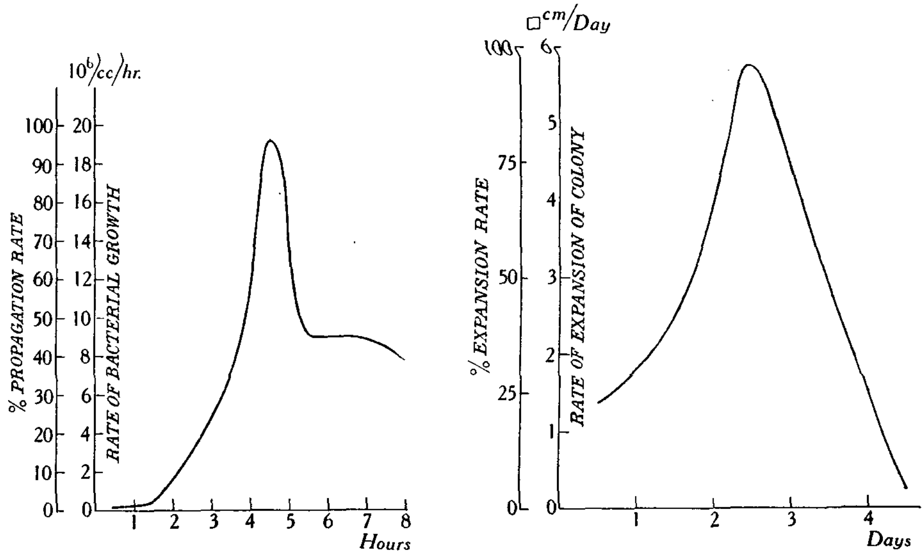
This curve indicates that the maximum growth-rate acceleration was reached in 4·5 hours after inoculation, a quick retardation from 4·5 hours to 5·5 hours, and then a steady propagation rate for 1 hour followed by a steady reduction.

If the maximum reading is taken as 100, the percentage of available bacteria propagating is easily shown. This method of expressing the curve should prove of immense interest to the bacteriologist in indicating at what period the optimum propagating rate is reached.



Graph 1. Propagation rate (*B. coli*).
Graph 2. Propagation rate (*B. dendroides*): rate of expansion of colony per day.

Graph 2 indicates a curve of the rate of expansion of a colony of *B. dendroides* per day, and shows the maximum acceleration of colony size that occurs in 2·5 days.

The application of this method to all bacterial growth-rate curves should materially help in the solving of problems relating to the physiology and biochemistry of bacteria.

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