SCIENCE

VOL. 100 FRIDAY, DECEMBER 15, 1944 NO. 2607

SCIENCE: A Weekly Journal devoted to the Advancement of Science. Editorial communications should be sent to the editors of SCIENCE, Lancaster, Pa. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

AMERICAN MATHEMATICS IN THE PRESENT WAR[1]

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THE topic of my remarks this evening is a rather serious one to take up after a dinner so pleasant and so friendly as the one we have all been enjoying. Moreover, I fear that the tone of my discussion can not be altogether gratifying to our professional pride, since the history of American mathematics in the present war has been in many respects a story of frustration. I believe, however, that we should all look at the record at this moment when the urgency of our national cause gives every detail of that record the fullest possible significance—and yet at a time when the inevitable note of protest can in no sense be interpreted as obstructing positive achievements on the part of those charged with the ultimate responsibility. The fact is that important lessons can be drawn from a recital of the record; and this is the time to draw them.

The history of American mathematics in the present war is complex and can be approached in a variety of different ways. I was rather at a loss to choose among them until finally the circumstances of this essay into historical expression made it clear to me that the most satisfactory plan would be to trace the sequence of events against the time-scale of the war itself. With this point of view in mind I spent part of the afternoon in drawing up a chronological table which I propose to follow this evening.[2] With all the cross-links displayed, I must confess that my chart is reminiscent of a topologist's nightmare!

Many of you will recall our summer meeting in Madison five years ago. That meeting began only a few hours after the invasion of Poland. The long-

[1] This paper represents the final version of an address delivered on August 13, 1944, before the American Mathematical Society at its summer meeting in Wellesley, Massachusetts.

[2] See the chart presented on page 533.

It occurred to us, therefore, that a basal medium of constant composition would be of great value in routine control assay work as well as in collaborative research. The preparation of a basal medium possessing the above qualities has been successfully accomplished in our laboratory and has prompted our describing it here.

In the preparation of the riboflavin basal medium alkali-treated photolyzed peptone, l-(-)-cystine and a yeast supplement, prepared and combined in the generally accepted manner,[1,2] were dissolved in a minimum quantity of distilled water (approximately 5.0 per cent. solids) and adjusted to pH 6.6–6.8 with 5N sodium hydroxide using brom thymol blue as an outside indicator. The solution was then dried from the frozen state for a period of thirty-six hours after which the dehydrated residue was removed and stored over phosphorus pentoxide at room temperature. A 2.25 per cent. solution of the desiccated product was used for the riboflavin basal medium to which was added anhydrous glucose at a level of 2.0 per cent. Results with this basal medium over a period of twelve weeks are summarized in Table 1.

TABLE 1

THE RESPONSE OF LACTOBACILLUS CASEI TO RIBOFLAVIN ON A 2.25 PER CENT. SOLUTION OF A CONCENTRATED BASAL MEDIUM STORED AT 75° F. OVER PHOSPHORUS PENTOXIDE FOR A PERIOD OF TWELVE WEEKS

	Lactic acid production (cc N/10 NaOH)									
Micrograms riboflavin	Trial No. 1	Trial No. 2	Trial No. 3	Trial No. 4	Trial No. 5	Trial No. 6	Trial No. 7	Trial No. 8	Mean	Mean per 0.05 microgram increments of riboflavin
0.00	1.15	1.50	1.95	1.65	2.30	2.10	1.40	1.50	1.69	...
0.05	3.20	3.50	4.60	3.40	4.25	4.05	3.60	3.70	3.78	2.09
0.10	5.55	5.85	6.65	5.60	6.55	6.30	6.35	6.00	6.11	2.33
0.15	7.50	8.20	8.30	7.45	8.65	8.75	8.40	8.15	8.18	2.07
0.20	8.90	9.30	9.65	8.40	9.70	10.00	9.80	9.20	9.37	1.19
0.25	9.75	10.30	10.50	9.00	10.05	10.55	10.25	9.60	10.00	0.63
0.30	10.25	10.55	10.80	10.10	10.75	11.05	10.55	10.65	10.59	0.59

A dehydrated basal medium for the assay of niacin has been obtained in a similar manner. Ingredients of the medium were prepared and combined in the proportions described by Krehl and co-workers.[4] In addition, a "folic acid" concentrate was added. The desiccated product was stored over phosphorus pentoxide at room temperature as in the case of the riboflavin basal medium. A 2.0 per cent. solution of this product was used for assay purposes. Anhydrous glucose and sodium acetate were added at a level of 4.0 per cent. Preliminary data obtained with this basal medium over a storage period of three weeks indicate results as successful as were obtained with the riboflavin basal.

Results obtained on the above described concentrated basal media are encouraging from the standpoint of standardization of microbiological assay methods. Many variables affect reproducibility of standard curves in the average control laboratory. Practical variations in incubation time, use of different incubators whose temperature controls vary in precision, different operators and the use of several lots of only approximately standardized alkali contribute to variations in standard curves. It has been impossible in this preliminary work to attempt rigid control of these various factors. We believe, therefore, since the basal used throughout this study was from a homogenous lot and since there is no apparent trend in variability, that this medium has maintained its original characteristics for a period of twelve weeks.

In view of these conclusions, together with the economy of time involved, it seems feasible that this type of product is justified for general use in microbiological assay.

Investigations are underway on the preparation of such basal media for pantothenic acid and "folic acid" as well as for media used in the microbiological assay of the amino acids. A complete manuscript describing details of the procedure involved will appear later.

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