

older than the Jaunsar-Simla formations. In the nappe zone, however, they are either thrust over the Jutogh's or they form cores of the Jutogh folds.

In the end I have to state that my conclusions were based on the study of the Sirmoor Hills to which they are largely applicable. The extension of these views to areas outside Sirmoor is merely suggested as a possibility in view of the fact that these tectonic features are generally regional and not strictly local. Only a detailed study of any area in the light of these considerations would prove their applicability or otherwise to that area.

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January 17, 1944.

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ALGAL STRUCTURES FROM THE CÚDDUPAH LIMESTONES (PRE- CAMBRIAN), S. INDIA

WITH reference to the note published on this subject in the July number of *Current Science*, I should like at the very outset to correct the impression conveyed in the second para of that note, that Professor Sahni has "agreed that the structures referred to above are of plant origin". Professor Sahni's view in the matter is that "While it is possible that some of the concretion-like growths are due to *plant activity*, there is no evidence whatever of plant structure. I include here what you refer to as algal dust".

Since publishing the note the material has been further investigated and many more sections of this limestone showing these structures



FIG. 1. Algal nodule (*cf. Cryptozoon.*) from
Royalcheruvu. $\times \frac{3}{4}$ (ca).

have been cut and examined. More recently I have also visited the area near Royalcheruvu, Ananthapur District, and have now been able to collect specimens of limestones showing structures remarkably similar to those described under the name '*Cryptozoon proliferum*' by C. L. and M. A. Fenton,¹ from the Upper Cambrian of Pennsylvania. The rock frequently shows a number of columnar bodies of calcium carbonate tapering at one end, occurring either as free individuals or in groups when they are fused together at the bottom by horizontal or curved extensions, suggesting a

colonial habit. They vary from about 1 to 2½ inches in diameter, and in a transverse view, on a polished surface of the rock, numerous irregularly concentric lines of growth can be seen; and the whole structure reveals characteristic porcellanoidal patches suggestive of algal origin. When examined under the microscope, these patches are seen to consist of aggregates of minutely crystalline calcite always having a different degree of crystallinity from the rest of the rock, and presenting a dark dusky appearance in reflected light strikingly similar to the 'algal dust' described and figured by Alan Wood² from the Carboniferous of England.

While it is true that definite recognisable plant-cell structures as such, have not been so far noticed, all other evidences, however, compel the author to believe that these structures are of organic origin and referable to algal activity. A full description of these structures is under preparation and will be published as early as possible.

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February 8, 1944.

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1. C. L. and M. A. Fenton, *American Midland Naturalist*, 1937, 18, 435. 2. Alan Wood, *Geol. Mag.*, 1941, 78, 192.

MICROBIOLOGICAL ASSAY FOR PANTOTHENIC ACID

SINCE the discovery that the chick antidermatitis factor¹ is identical with pantothenic acid,^{2,3} attempts have been made to estimate this vitamin in different biological materials. The two methods commonly used are (a) the chick growth method⁴ and (b) the microbiological method employing *Lactobacillus casei*⁵⁻⁸ and *Proteus morganii*⁹ as the test organisms. In a previous paper¹⁰ pantothenic acid was shown to be essential for the growth of *Lactobacillus bulgaricus*. It was felt to be of interest to discover whether this organism could be used as a test organism for the assay of pantothenic acid.

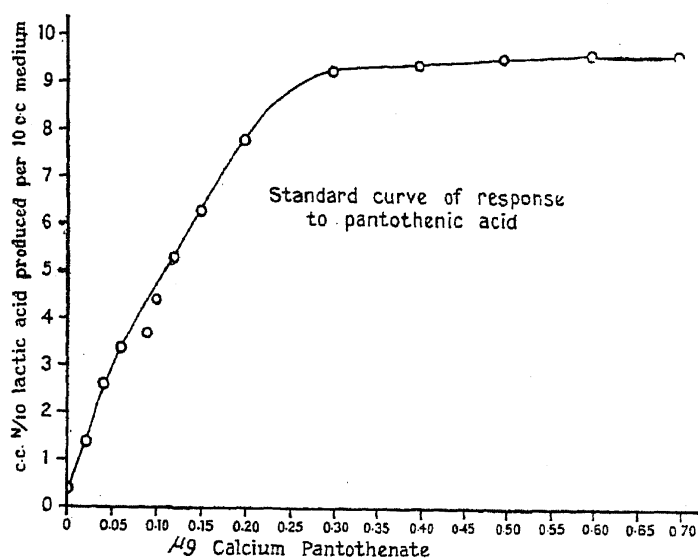
The basal medium, inoculation and the assay procedure were essentially the same as those described by Pennington *et al.*⁶ The growth response of *L. bulgaricus* to different concentrations of calcium pantothenate (0.02-0.70 μ g. per 10 c.c. medium), as determined by the amount of lactic acid formed in 72 hours at 37° C., is shown in the figure.

The values shown in the figure could be satisfactorily reproduced within a wide range (0.01-0.15 μ g. Ca pantothenate). The curve is linear, thereby indicating the suitability of this organism for the assay of pantothenic acid.

The pantothenic acid content of samples of dried yeast, yeast extracts and animal tissues was estimated using *L. bulgaricus*. The samples, after 48 hours autolysis, were autoclaved and the extracts *thus* obtained were used at two levels for the assay. The results are presented in the table.

The reliability of the response of *L. bulgaricus* as a measure of pantothenic acid is sup-

ported by the facts that (a) the results calculated from two different levels agreed satisfactorily, (b) pantothenic acid added both to



Pantothenic Acid Content of Yeast,
Yeast Extracts and Animal Tissues

Weight of test sample added to basal medium (mgs.)	µg. Ca pantothenate per gm.	% Recovery of added pantothenate
Brewer's yeast, dried	0.4 130 133	90 90
Torula yeast, dried	0.4 84 84	86.7 88.4
Yeast extract (1)	0.2 290 295	107.0 103.5
" " (2)	0.2 280 282.5	100.0 100.0
Alkali-treated yeast extract	0.4 0 0	100.0 100
Ox liver	0.4 60.0 59.5	90.0 90.0
Sheep kidney	0.4 26.0 28.0	90.0 90.0
Sheep heart	0.4 16.0 14.5	82.0 82.0

intact materials and materials in which pantothenic acid was destroyed by autoclaving with strong alkali was satisfactorily recovered, and (c) the values obtained are in good agreement with those reported by other workers for yeast, yeast extracts¹¹ and animal tissues.¹²

The method is now being extended for the estimation of pantothenic acid in other biological materials. The organism employed in this investigation was obtained from The National Collection of Type Cultures, India, Indian Institute of Science, Bangalore, to whom my thanks are due.

Nutrition Research Laboratories,
Indian Research Fund Association,
Coonoor, KAMALA BHAGVAT.
February 8, 1944.

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FREEZING TEST FOR DETECTING ADULTERATION IN EDIBLE OILS

SESAME and mustard oils are generally used in this country as fat foods. To a limited degree coconut oil and nigerseed oil (kurdi oil) find popularity in certain parts of the country. Groundnut and other oils from vegetable sources such as sunflower oil, etc., are used only as adulterants for the above class. Detection of adulterations in market samples of sesame and mustard oils with the said common adulterants is a matter of considerable difficulty to the Public Analyst. The procedures leading to detection of such adulterations are tedious and require a well-equipped and staffed laboratory. In a case like the admixture of sesame oil with kurdi or kursani oil, detection is extremely difficult if not impossible in that the 'analytical constants' have the same ranges. Further the present methods detect adulteration and quantitative estimation of the components are considered far from being satisfactory. The public have no easy means to judge for themselves the market samples prior to purchase.

A few observations made by the author in the course of his work would throw some light on the question. Fresh or aged samples of genuine sesame oil and mustard oil retain their liquid consistency when cooled to the temperature of ice, whereas groundnut oil and nigerseed oil freeze to ghee-like solid at the said temperature. Mixtures of the two groups will likewise solidify at zero degree Centigrade, with this important difference that depending on the quantities of the adulterants the time taken to freeze varies. Thus it is found that if groundnut oil forms only 5 per cent. of the mixture, freezing to solid occurs in 14 hours, whereas with this component in 30 per cent. and above, brings about the same change in half an hour. In the case of nigerseed oil, for the detection of which there appears to be no method at present, freezing takes place only when it is in more than 30 per cent. in admixture. Since the procedure needs no chemicals or scientific apparatus, the test is considered very handy for the public as well as the Public Analyst.

The test itself may be performed by taking as much as a quarter ounce of the oil in a glass bottle, preferably thin-walled and kept surrounded in a container with ice broken into small fragments. If solidification takes place in less than an hour's time, it can be taken to mean that the sample is not only adulterated but that the adulterant is groundnut oil which constitutes at least 30 per cent. It is considered that the method may be improved to yield quantitative results.

Surat,
January 1943.

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