kept for fifteen minutes in a thermostat maintained at any desired temperature to within ± 0·02°. The balance weighed correctly to 0·1 mgm. and the method of double weighing was employed, correction being applied for bouyancy. A set of standard weights with N. P. L. certificate was used.

The results obtained are shown in Table I.

TABLE I.

Densities of aqueous solutions of formaldehyde in terms of the density of water at 4° C.

Grams of formaldehyde in 100 c.c. sol.	D_{20}	D_{25}	D_{30}	D_{35}	D_{40}
2·76	1·0065	1·0054	1·0037	1·0020	1·0001
6·3	1·0167	1·0152	1·0136	1·0115	1·0097
11·55	1·0329	1·0303	1·0284	1·0263	1·0242
14·43	1·0403	1·0385	1·0365	1·0344	1·0321
19·3	1·0552	1·0531	1·0510	1·0486	1·0462
25·26	1·0703	1·0681	1·0658	1·0633	1·0606
30·9	1·0859	1·0835	1·0808	1·0782	1·0754
37·35	1·1013	1·0987	1·0961	1·0933	1·0904
41·43	1·1126	1·1099	1·1071	1·1042	1·1019

Gujerat College, Ahmedabad, February 26th, 1935.

S. N. DATAR.

[1] Arbeaten aus dem Kaiserlichen Gerandheit samte.—*Zweiundzwanzigster Band*, 1905.

Culture of Micro-Organisms on Cellophane Membrane.

IN the course of our studies on the mechanism of nitrogen fixation, it was found necessary to obtain considerable quantities of bacterial (azotobacter) growth free from the solid constituents of the culture media. By covering the solid medium with cellophane membrane, it was thought that the crystalloidal constituents comprising the greater portion of the nutriment, would permeate through the membrane and be made continually available to the growth of the bacterium while the solid medium underneath would, as usual, serve as the reservoir of nutrients and water.

The experimental technique consisted in covering the surface of the solid medium (after setting in a petri-dish) with a sterile strip of moistened Cellophane, so that the membrane was in intimate contact with the surface of the medium. (Cellophane supplied by the British Cellophane Company is used and it could be sterilised by heating it in an autoclave at 15 lbs. pressure for 15 minutes). The dish was inoculated in the usual manner. The organisms grew quite well on the media and the growth was found practically as satisfactory as the growth on plain, uncovered media. When sufficient growth had occurred, the membrane was lifted out of the dish and the bacterial growth easily recovered from the membrane.

The technique has now been successfully extended to other ærobic organisms. Attempts are also being made to apply the method to strict anærobes and to such parasites as normally grow only in association with their hosts.

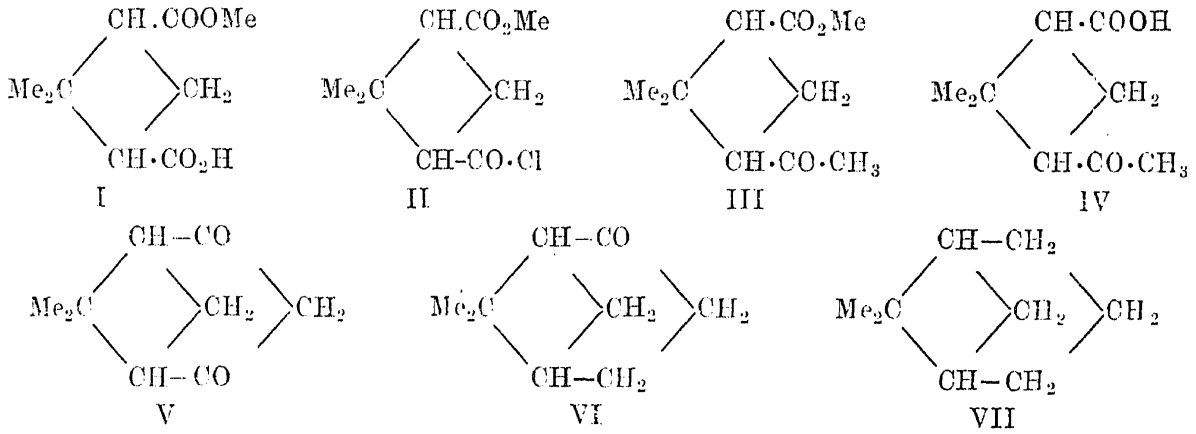
T. R. BHASKARAN.
M. SREENIVASAYA.
V. SUBRAHMANYAN.

Department of Biochemistry,
Indian Institute of Science,
Bangalore.
March 9th, 1935.

Synthesis of Pinononic Acid.

PINONONIC acid was obtained for the first time by Wagner and Ertschikowski[1] by the oxidation of α-pinene which contained some verbenone or verbenol, and later on Kerschbaum[2] and Blumann and Zeitschel[3] got the same by oxidising verbenone. Fromm and Autin[4] obtained the same acid by the oxidation of olibanol the constitution of which is not yet definitely known. The establishment of the constitution of verbenone, depends entirely on the synthesis of pinononic acid. This has now been achieved in the course of our attempts to synthesise pinene and verbenone starting from norpinic acid.

trans-Norpinic acid prepared according to the method of Kerr[5] with slight modifications, was converted into the *cis*-anhydride in an yield of 80-85 per cent. of theory by heating it with acetic anhydride in a sealed tube at 190-200°. This on being treated with an equimolecular quantity of sodium methoxide in methyl alcohol gave the sodium derivative of *cis*-norpinic acid monomethyl ester (I) in almost quantitative yield.



The acid chloride (II) prepared from the mono-acid (I) with thionyl chloride, gave on treatment with one molecule of zinc-methyl-iodide, pinononic acid methyl ester (III) b.p. 130-135°/14 mm. obtained previously by Wagner and Ertschikowski[6] by esterifying the acid obtained from pinene by oxidation. This ester has been hydrolysed by alcoholic potash to pinononic acid (IV) m.p. 129°: semicarbazone, m.p. 209°.

Work on the conversion of methyl pinononate (III) into "ketonopinone" (V) by the elimination of a molecule of methyl alcohol is in progress which it is expected on reduction will yield nopinone (VI) and nopinane (VII).

P. C. GUHA.
K. GANAPATHI.

Department of Organic Chemistry,
Indian Institute of Science,
Bangalore,
April 2, 1935.

[1] *Ber.*, 1896, **29**, 881.
[2] *Ber.*, 1900, **33**, 890.
[3] *Ber.*, 1913, **46**, 1194.
[4] *Ann.*, 1913, **401**, 256.
[5] *J. Am. Chem. Soc.*, 1929, **51**, 614.
[6] *Loc. cit.*

Aerial Roots in Sorghum.

THE grain sorghum plant is usually single headed. When the head develops and gets weighty the plant supports itself on roots formed from the nodes immediately above the ground. Nodes up to four may usually function in such effective root production, though occasionally (according to vigour and closeness of the internodes) the number might go up to even ten. With the setting of the grains and the drying up or falling off of the lower leaves, ærial roots appear. In some cases such roots pierce through the persistent leaf sheaths. Their emergence is marked by knobs on the sheath surface. To determine the effect of the leaf sheath in such root formation 50 plants in the local Peria Manjal variety of sorghum were de-sheathed when 50 days old, with 50 other plants for a control. Observations on the emergence and distribution of ærial roots were made at intervals. Five days after de-sheathing 39 plants so de-sheathed started to develop roots, whereas only 4 in the sheaths-intact group showed such activity. After a month, in the 50 plants of the sheaths-intact group, 4 plants developed no ærial roots, 30 developed them in the first node above the ground, 14 in the first two nodes, 1 in three nodes and 1 in four nodes. In the de-sheathed group all developed roots, 11 of them in two nodes, 32 in three nodes and 7 in four nodes (*vide* Fig. 1). The

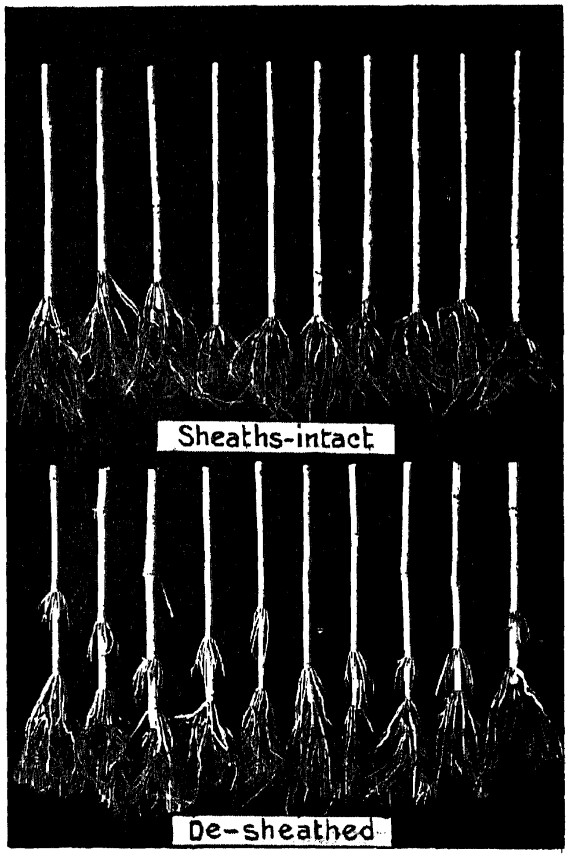


Fig. 1.