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The effects of yeast vitamine water-soluble B on plant cell-masses and on biocolloids.

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One of the most clearly outstanding results to be derived from my measurements of imbibition by cell-masses, and of swelling of biocolloids (agar-pentosan mixtures) is that solutions which promote growth in plants increase hydration in living and dead cell-masses and of agar or agar protein mixtures.

As the first step in testing the effects of vitamine, water-soluble B on the growth of some higher plants, its action in hydration was measured on a variety of materials at 15° C. at the Coastal Laboratory, Carmel, California, July to October, 1918. A solution of 1 part in a thousand in distilled water from a preparation furnished by Dr. Isaac Harris was used. Even when prepared under chemically clean conditions and kept in the dark at 15° C. deterioration began within 40 hours and hence freshly made solutions were used, which tested by acidity by the indicator method showed a P_H of 5.25.

The auxograph was used in taking the measurements, trios of sections or of roots being placed in stender dishes into which the solutions were poured. Taking the swellings in water as 100 hydration increases were measured as follows:

Potato tubers, young, sections	75
Potato tubers, large, sections	230
Squash fruits, young, sections of pulp	110
Squash fruits, mature, sections of pulp	115
Orange seedlings, root tips, living	150
Orange seedlings, root tips, dried	120
Corn root tips, small, living	88
Corn root tips, large, living	78
Corn root tips, large, dried	180
Strawberry root tips, living	133
Sunflower stems, sections of pith, mature, living	150
Opuntia, sections of young joints	94
Opuntia, sections of mature joints	170
Opuntia, dried slices	90

It is to be seen from the above that of living cell masses from eight different plants, five showed a greater hydration capacity in the vitamine solution than in water, two were notably less and one had a swelling capacity only slightly less than in water. Of the five which gave excessive enlargement in a living state, two were tested in mature condition and also found to show a high capacity in the vitamine.

Two of the five which showed excessive swelling in a living condition, repeated this action in a dried condition. Lastly it was found that of the three kinds of cell-masses which did not give the normal hydration in vitamine, two gave an excessive swelling in a dried condition.

Coincidently various colloidal preparations were hydrated in the vitamine solution and the swellings at 15° C. relative to that in water are given below.

Agar	140
Agar and "salts"	73
Agar and soap	132
Agar and potassium oleate	80
Agar 3, gelatine 2	136
Agar and phenyl alanine	95
Agar 3, gelatine 2 and "salts"	130
Agar 3, gelatine 2, soap	92
Agar 3, gelatine 3	135
Agar 2, gelatine 3	143
Agar 2, gelatine 3 and "salts"	130
Gelatine	163
Gelatine and "salts"	80
Gelatine and soap	92

The "salts" of the above mixtures consisted of 20 cc. KCl at 0.001M; 12 cc. NaCl at 0.001M; 2 cc. CaCl at 0.0001M, added for each gram of air dried material in making up the colloidal mixtures in water before casting and drying. The soap was a well-known brand sold in flakes and was used as one to a thousand in the colloidal preparation to which it was added. The agar used alone was a purified preparation by Dr. Harris, but bacto-agar was used in the preparation containing soap.

Finally a preparation of agar in which one thousandth part of the amino-acid phenylalanine had been incorporated was hydrated in the vitamine solution with results not essentially

different from swelling in water, and the incorporation of yeast vitamine in agar apparently did not increase its swelling capacity although such preparations showed a high hydration capacity in balanced solutions of sodium and calcium chloride in which the first substance was used at 0.0001M.

If we now review the above measurements, the following general statements are seen to be supported:

1. A solution of water soluble B, yeast vitamine at 0.1 per cent., $P_H = 5.25$, causes a hydration in excess of that which may take place in water in agar, agar and soap, agar-gelatine, agar-gelatine and salts in various proportions, and in gelatine.

2. Lessened hydration ensues in agar and salts, agar-gelatine and soap, gelatine and salts, and gelatine and soaps.

3. Mature fruits, pith and joints of plants show excessive swelling in vitamine solutions.

4. Dried cell masses of roots and joints of *Opuntia* show excessive swelling in vitamine solution.

5. Lessened hydration ensues in young tubers of potato and roots of corn, a result parallel to those obtained from mixture of agar, gelatine and soap.

6. Increased hydration takes place in root-tips of orange seedlings and of strawberry plants.

The consideration of these results shows that the effects of this vitamine may not be attributed simply to included amino acids of which nucleic is the most prominent in this instance, nor may they be ascribed to the action of the hydrogen ions at the given concentration, nor to the extremely minute proportions of salts which might be present.

It is suggested that their accelerating action on such unlike colloids might be due to action of various components inert to each other and with effect on but one of the main components of the biocolloids of the mixtures or of living matter.