LETTERS TO THE EDITORS

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Enzymic Formation of *nor*Adrenaline in Mammalian Tissue Extracts

THE possibility that *nor*adrenaline carboxylic acid, 3,4-dihydroxyphenylserine, might be a precursor of adrenaline has been suggested previously¹. Recently, it has found experimental support². Experiments carried out in Oxford³ have shown that *levo-nor*-adrenaline was formed when the amino-acid was decarboxylated by bacterial preparations; but no similar reaction was observed in mammalian tissue extracts.

Another specimen of dihydroxyphenylserine has recently been examined in Glenolden; it was found that it gave rise to a pressor substance and carbon dioxide when incubated with mammalian tissue extracts. Too little of the material was available for a full analysis of its stereochemical configuration and of the exact nature of the pressor agent formed.

These findings have led to a re-examination in Oxford of the specimen used in the earlier work (prepared by Dalglish and Mann⁴). A slow formation of carbon dioxide was observed when the amino-acid was incubated anaerobically with extracts of guinea pig's kidney. The incubated extracts were assayed on the spinal cat; arterial blood-pressure and contractions of the nictitating membranes were recorded. The results indicate that the amine formed was *levo-nor*adrenaline. Similar results were obtained with another specimen of the amino-acid previously used by Guggenheim⁵ (and kindly put at our disposal by Messrs. Hoffman La Roche, of Basle). These observations strongly suggest that the substance used in Glenolden also had the same configuration and that the amine formed was also *nor*adrenaline.

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¹ Rosenmund, K. W., and Dornsaft, H., *Ber. d. deutsch. chem. Gesellsch.*, 52, 1734 (1919).

² Beyer, K. H., "Chemical Factors in Hypertension", "Advances in Chemistry" (*Amer. Chem. Soc.*, in the press).

³ Blaschko, H., Holton, P., and Sloane Stanley, G. A., *Brit. J. Pharmacol.*, 3, 315 (1948).

⁴ Dalglish, C. E., and Mann, F. G., *J. Chem. Soc.*, 658 (1947).

⁵ Guggenheim, M., "Die biogenen Amine", 431 (3rd edit., A. Karger, Basle and New York, 1940).

Effect of Aeration on the Cytochrome Systems of the Resting Cells of Brewers' Yeast

BREWERS' yeasts have a lower respiration and, usually, a higher fermentation than bakers' yeasts. The absorption spectrum of their cytochrome differs from the typical four-banded spectrum of bakers' yeast¹ in showing only two distinct bands in the visible region². By increasing the oxygen supply

during growth, their absorption spectrum was changed into that of 'bakers' yeasts'³. Similar changes have also been noticed in *Aspergillus oryzae*⁴. Since all these experiments were conducted under the conditions which allow cell proliferation, it was naturally considered that the observed changes were due to a selection of certain cells, the multiplication of which was favoured by aeration.

In the present communication, it is shown that an alteration both in the cytochrome components and in the metabolic activities can be demonstrated during resting metabolism of brewers' yeasts, thus excluding the possibility that certain cells were selected during the process. For this study, top fermenting brewers' yeast, 36-48 hours old, was obtained from a local brewery (Greene King). Microscopic examination with Methylene Blue (1:10,000 at pH 5.5) showed that the number of dead cells was negligible. The yeast was washed twice with distilled water and once with phosphate buffer, and suspended in *M/15* phosphate buffer, pH 5.5, containing 0.04 per cent magnesium sulphate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) and 2 per cent glucose. Suspensions were then aerated at 30° C. in a plugged glass cylinder to the bottom of which was fused a sintered glass disk of the same diameter (6.5 cm.) as the cylinder. Similar suspensions, serving as controls, were incubated at the same temperature without aeration. Samples were taken out at intervals for spectroscopic and manometric experiments. Throughout the whole period of the experiments no contamination was observed microscopically. Very few dead cells were found during an 8-hour incubation, but the number tended to increase after twelve hours.

Spectroscopic examination. Examination of the cytochromes of the top brewers' yeast with a micro-spectroscope showed the α -bands of two cytochromes: b_1 , asymmetrical and lying at 550-566 m μ , and a_1 , weak and very diffuse at 585-590 m μ . The corresponding β -bands were generally diffuse and lying at 521-538 m μ with a maximum around 530 m μ . When a suspension of the yeast was cooled in liquid air, the b_1 -band split into three components: (1) a very strong b -band at 560 m μ , (2) a weak, narrow c -band at 548 m μ , and (3) a very weak e -band⁵ at 556 m μ , while the β -bands also sharpened into two clearly separated bands at 530 and 519 m μ .

After two hours aeration, spectroscopic examination at room temperature showed that the b_1 band had split into b - and c -bands at 560-566 and 550 m μ respectively, the latter band being the stronger. The diffuse background to b and c persisted, as did also the band a_1 , although this had in part been replaced by a narrow a -band at 605 m μ . After four hours aeration the c -band became very much intensified, while the b -band diminished to a weak shadow. The a -band was now fairly strong but there was no trace of e or of a_1 , except after cooling in liquid air, when e could just be detected. The maximum of the β -bands had shifted from 530 to 521 m μ . Two more hours aeration caused no further change in the general spectral pattern, but the intensities of c , and especially of a , increased to a maximum value. The resulting spectrum of the transformed yeast was now quite similar to that of an ordinary bakers' yeast, except that the b -band was somewhat weaker. In unaerated controls the bands remained unchanged. Efforts to change the resting transformed yeast back into its original state by resuspending the transformed cells in the same