brain constitutes more than 30% of the tissue weight. In the present experiments, the changes brought about in the arterial bicarbonate concentration were around 10 mE/kg, which should have changed the bicarbonate concentration of the water phase of the tissue about 3 $\mu$E/g of tissue water, had there been such a diffusion equilibrium. The experiments are only compatible with two possibilities: (1) The bicarbonate ions and the hydrogen ions of blood plasma are in diffusion equilibrium with an extracellular space which is so small (probably less than 5% of the tissue weight) that the present technique cannot detect the induced changes in extracellular bicarbonate. (2) Anatomical or functional barriers prevent free diffusion of bicarbonate ions and hydrogen ions between blood plasma and the existing extracellular space[8].

*Zusammenfassung.* Die Frage des passiven Transportes von $HCO_3^-$- und $H^+$-Ionen zwischen Blutplasma und Gehirngewebe wurde untersucht. Die Blutkonzentration dieser Ionen wurde durch intraperitoneale Injektionen variiert und der Gesamt-$CO_2$-Gehalt des Gehirngewebes nach 1–12 h bestimmt. Es ergab sich keine signifikante Änderung im Gesamt-$CO_2$-Gehalt des Gewebes, obwohl der Standardbikarbonatgehalt des Blutes mit 10–13 mE/l verändert wurde.

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## Mannan from the Extracellular Surface of *Candida albicans* Berkhout

From the surface of cellular membranes of the pathogenic yeast *Candida albicans* Berkhout, strain number 109[1,2], extracellular surface polysaccharide was isolated in such a way that after the removal of the cultivating medium the cells were washed with warm water under constant microscopic control. The wash waters were centrifuged, dialyzed and precipitated with alcohol. The precipitated polysaccharide was freed from protein[3] and after lyophilization obtained as a nitrogen-free white powder in yields of 2.5–3% calculated on dry yeast material. The homogeneity of the isolated polysaccharide was determined by free electrophoresis in borate buffer (pH 9.3).

On hydrolysis the polysaccharide gave as the only sugar D-mannose identified by paper chromatography[4,5], paper electrophoresis using borate buffer and by the preparation of the *p*-nitrophenylhydrazone[6].

Water soluble extracellular surface mannan had an average polymer degree of 36 and showed a specific rotation $[\alpha]_D^{20} = +56°$. After methylation[7,8] and hydrolysis of the mannan, the following derivatives were obtained: 2,3,4,6-tetra-o-methyl-, 3,4,6-tri-o-methyl- and 3,4-di-o-methyl-D-mannose. The individual methyl ethers were identified by thin layer chromatography on silica gel using the system isopropylalcohol-ethyl acetate-water (1:4:2.5), and their relative amounts determined according to HAY[9] were in the ratio of 1:3:1.

Periodate oxidation used 1.08 mol of sodium metaperiodate giving 0.2 mol of formic acid for each mol of anhydromannose. The polyaldehyde formed by periodate oxidation was reduced and hydrolysed. Glycerol was found to be the only polyalcohol[10] present in the hydrolysates. The results of the periodate oxidation supported the conclusions drawn from the methylation analysis. From the decrease in optical rotation after acid hydrolysis and from the infrared spectrum[11] it was found that in the extracellular surface mannan $\alpha$-glycoside bonds are present.

On the basis of the above experimental data, the mannan from the extracellular surface of *Candida albicans* is a branched polysaccharide composed of D-mannopyranose units bound by $\alpha$-1-2 and $\alpha$-1-6 bonds. It is not identical with the intracellular mannan isolated by BISHOP[12] from the cellular walls of *Candida albicans* in that it shows a lower degree of branching.

A full report of this work will be published in Chemické zvesti.

*Zusammenfassung.* Aus der Oberfläche der Zellmembranen von *Candida albicans* Berkhout wurde ein Mannan isoliert, das aus D-Mannose aufgebaut ist. Durch Methylierung und anschliessende saure Hydrolyse wurde bewiesen, dass es sich um ein verzweigtes Mannan mit $\alpha$-1-2- und $\alpha$-1-6-Bindungen handelt.

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[1] A. KOCKOVÁ-KRATOCHVÍLOVÁ, J. ŠANDULA, and L. HRONSKÁ, Fol. microbiol. (Praha) *8*, 109 (1963).
[2] J. ŠANDULA, A. KOCKOVÁ-KRATOCHVÍLOVÁ, and M. ZÁMEČNÍKOVÁ, Fol. microbiol. (Praha) *8*, 313 (1963).
[3] M. G. SEVAG, Biochem. Z. *273*, 419 (1934).
[4] E. CHARGAFF, C. LEVINE, and C. GREEN, J. biol. Chem. *175*, 67 (1948).
[5] S. M. PARTRIDGE, Nature *164*, 443 (1949).
[6] C. L. BUTLER and L. H. CRETCHER, J. Am. chem. Soc. *53*, 4363 (1931).
[7] W. N. HAWORTH, J. chem. Soc. *107*, 13 (1915).
[8] R. KUHN, H. EGGE, R. BROSSMER, A. GAUHE, P. KLESSE, W. LOCHINGER, E. RÖHM, H. TRISCHMANN, and D. TSCHAMPEL, Angew. Chem. *72*, 805 (1960).
[9] G. W. HAY, B. A. LEWIS, and F. SMITH, J. Chromatogr. *11*, 479 (1963).
[10] M. VISCONTINI, D. HOCH, and P. KARRER, Helv. chim. Acta *38*, 642 (1955).
[11] S. A. BARKER, E. J. BOURNE, R. STEPHENS, and D. H. WHIFFEN, J. chem. Soc. *1954*, 3468.
[12] C. T. BISHOP, F. BLANK, and P. E. GARDNER, Can. J. Chem. *38*, 869 (1960).