This research was supported in part by the *Swedish Technical Research Council* and by the *Office of Research and Development, U.S. Army Department*, through its European Office. Part of this work was carried out during the tenure of a Post-doctoral Fellowship by one of us (V.P.A.) awarded by *Ciba Fellowship Trust*, Cambridge.

1. Enzell, C. *Svensk Kem. Tidskr.* **72** (1960) 602.

Received January 14, 1961.

Cytochrome c from *Salmonella typhimurium*

MARK RICHMOND and NIELS OLE
KJELDGAARD

*Universitetets Mikrobiologiske Institut, Øster
Farimagsgade 2 A, København K, Denmark*

In the course of growth experiments with *Salmonella typhimurium*, it was found that organisms grown in a simple synthetic medium with L-glutamate as sole carbon

Fig. 1. Absorption spectra (1.0 cm light path) of the oxidised (+) and reduced (●) forms of the cytochrome preparation extracted from *Salmonella typhimurium*. The cytochrome was reduced with $\text{Na}_2\text{S}_2\text{O}_4$.

Table 1. Relative extinction coefficients of bacterial cytochrome c preparations.

Organism	Reduced		Oxidised	
<i>A. vinelandii</i>	E_{416}	E_{555}	E_{551}	E_{409}
(C_4)	9.0	1.0	1.32	6.8
<i>S. typhimurium</i>	9.6	1.0	1.3	7.1

source were pink when looked at in bulk by transmitted light. Glucose grown organisms of the same strain were white or pale cream under similar conditions and a difference spectrum (glutamate cells/glucose cells) taken at high suspension densities showed strong absorption bands in the regions 400–420, 515–530 and 540–560 $\text{m}\mu$ for glutamate grown cells. These absorption bands suggested that the pink colour was due to cytochromes. Treatment of a dense suspension of glutamate grown bacteria (ca. 8 g wet weight of bacteria in all) as described by Tissières¹ produced material with the absorption spectrum shown in Fig. 1. Sharp peaks were found at 416, 525 and 551 $\text{m}\mu$ in the reduced form and at 409 $\text{m}\mu$ in the oxidised form. These peaks are located in exactly the same positions as the absorption peaks of the cytochrome C_4 isolated by Tissières¹ from *Azotobacter vinelandii*.

Comparison of the quantitative relationship between the extinction coefficients at the absorption peaks for these cytochromes (see Table 1) shows that the *Salmonella typhimurium* cytochrome is very similar to that from *Azotobacter vinelandii*, at least as far as absorption properties are concerned.

One of us (MR) would like to acknowledge the receipt of a CIBA Fellowship in support of this work.

1. Tissières, A. *Biochem. J.* **64** (1956) 582.

Received January 15, 1961.