

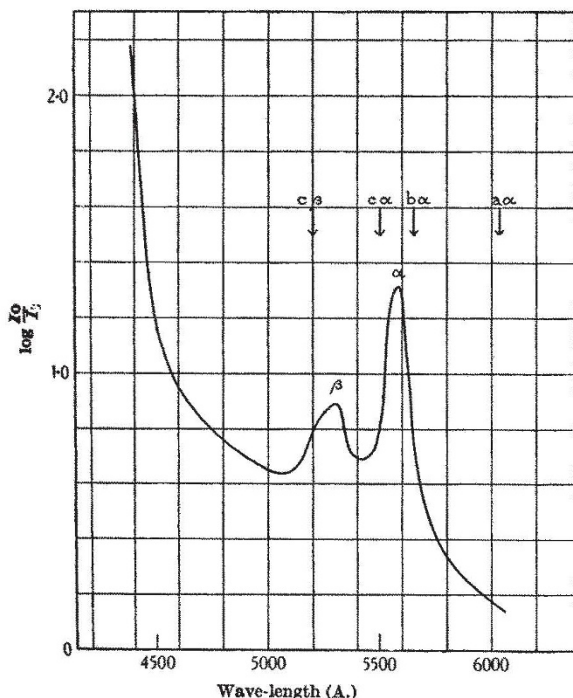
LETTERS TO THE EDITORS

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A New Soluble Cytochrome Component from Yeast

HITHERTO cytochrome *c* is the only component of cytochrome which has been obtained in solution, the others being attached to the insoluble parts of the cell structure.

During the purification and concentration of the lactic dehydrogenase of yeast, as described in a future communication, we have obtained a new cytochrome which is extremely soluble in water. The positions of the bands of its absorption spectrum do not correspond with those of any cytochrome component known hitherto. The new component appears to be present in yeast in amounts too small for its detection by direct spectroscopic observation of the yeast cells; but its spectrum becomes visible on removal of other coloured substances and concentration. We have obtained it in strong solution, red in colour, and free from other cytochromes. Its absorption spectrum in the reduced state, as determined in a Hilger-Nutting spectrophotometer, is shown in the accompanying graph, in which the positions of the bands of cytochromes *a*, *b* and *c*, as ordinarily seen in yeast, are also indicated. Its α band is situated at 5570 Å., between the α bands of cytochrome *c* (5500 Å.) and cytochrome *b* (5650 Å.); the β band, which is unsymmetrical, has its peak at 5300 Å. If a trace of cytochrome *c* is added, a distinct space can be seen between the α bands of the two cytochromes. In liquid air the bands become much sharper; the α band then appears double. The new component, unlike cytochrome *c*, is somewhat autoxidizable, and its bands disappear on shaking with air.



The spectrum is clearly that of a haemochromogen. This haemochromogen does not combine with carbon monoxide in neutral solution, and in this respect it resembles cytochromes *a*, *b* and *c*. On denaturation with dilute sodium hydroxide and addition of pyridine and hyposulphite, it is converted into pyridine haemochromogen, with absorption bands identical with those of pyridine protohaemochromogen. The pigment, therefore, has a protohaematin prosthetic group, like cytochrome *b* and unlike cytochromes *a* and *c*. By converting the pigment into its pyridine haemochromogen and comparison with standard haemochromogen solutions by the spectroscopic method described by Keilin¹, its concentration may be estimated with great accuracy. This makes it possible to calculate the absorption coefficient, which for the α band is found to be $\epsilon_{5570} = 0.4 \times 10^8$ cm.²/gm. atom Fe. The new cytochrome resembles cytochrome *b* not only in the nature of its prosthetic group, but also in being autoxidizable to some extent in neutral solutions. In order to avoid confusion with other haematin compounds, we suggest that it should be called cytochrome *b*₂.

Owing to the impossibility of obtaining Delft yeast, we have not been able to study the catalytic properties of cytochrome *b*₂ in detail. We have, however, found that it is not capable of replacing the substance² linking the succinic system with cytochrome *c* which is destroyed at pH 5, and which it has been suggested³ might be cytochrome *b* or a hitherto unrecognized component. The identity of cytochrome *b*₂ with the yeast lactic dehydrogenase is discussed in a future communication.

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¹ Keilin, D., *Proc. Roy. Soc.*, B, **113**, 303 (1933); *NATURE*, **148**, 493 (1941).

² Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **129**, 277 (1940).

³ Keilin, D., and Hartree, E. F., *Proc. Roy. Soc.*, B, **127**, 167 (1939).

X-Ray Study of the Elastic Constants of Metals

IN a recent letter¹ we showed that the diffuse X-ray reflections from single crystals of alkali metals are related to the elastic constants in just the way predicted by the Waller theory², as interpreted and applied by Jahn³. We are now able to give data for sodium which will illustrate this more conclusively.

The figures represent the intensity of diffuse reflecting power on the surface of a sphere surrounding the reciprocal lattice point (*hkl*), in the direction [*pqr*], as calculated from Jahn's formula. The observed intensities are derived from visual estimation on a series of Laue photographs taken at degree intervals, in various crystal orientations, the range of each set of photographs being sufficient to cover the entire observable reflecting region for each plane. Allowance has been made for the usual factors which affect the normal reflexions (structure factor, atomic scattering factor, factors involving the crystal and film positions relative to the incident beam), and which also, of course, affect the diffuse reflexions.