

Wolfenstein. The rates obtained by Lewis and by Williams at the higher altitude for a chamber separation of 10 metres and for showers of the same density are also much greater than the predicted rate, by factors of 280 and 12 respectively. Part of the discrepancy may well be attributed to Wolfenstein's inclusion of the zenith angle effect, whereas recent experiments² indicate that extensive showers penetrating to the lower altitudes are incident nearly vertically.

Further details of the present work are to appear in the *Australian Journal of Scientific Research*, Series A, 2 (1949).

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March 17.

¹ Lewis, L. G., *Phys. Rev.*, **67**, 228 (1945).

² Williams, R., *Phys. Rev.*, **74**, 1689 (1948).

³ Euler, H., *Z. Phys.*, **116**, 73 (1940).

⁴ Wolfenstein, L., *Phys. Rev.*, **67**, 238 (1945).

⁵ Carmichael, H., *Phys. Rev.*, **74**, 1667 (1948).

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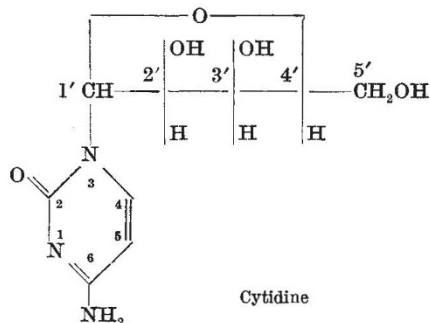
⁷ Bernadini, G., Cortini, C., and Manfredini, A., *Phys. Rev.*, **74**, 845 (1948).

⁸ Montgomery, C. G., and Montgomery, D. D., *Phys. Rev.*, **72**, 131 (1947).

⁹ Alichanian, A., and Asatiani, T., *J. Phys. U.S.S.R.*, **9**, 175 (1945).

Crystal Structure of Cytidine

A STUDY of the crystal structure of cytidine is being carried out by X-ray analysis. The crystal specimens were kindly supplied by Dr. D. O. Jordan, University of Nottingham, and were found to be orthorhombic with $\{110\}$ dominating. An optical investigation shows that the sign is positive, with $\alpha \parallel c$, $\beta \parallel b$ and $\gamma \parallel a$. Cell dimensions are: $a = 13.93$ A., $b = 14.75$ A., $c = 5.10$ A.; density, 1.53; four molecules per unit cell; space-group, $P 2_12_12_1$.



Weissenberg photographs were taken, approximate atomic co-ordinates postulated by trial and error, and the Fourier map of the 001-projection shown in Fig. 1 eventually obtained. This map is now being refined.

Fig. 2 gives the interpretation of the peaks. The chemical formula is fully confirmed, thus showing cytidine to be cytosine-3-*d*-ribofuranoside. The glycosidic linkage is of the β -type, in accordance with the findings of Davoll, Lythgoe and Todd¹. The bond-angles to the atom C1' of the five-membered ring are not far from the tetrahedral angle, and the planes of the two ring systems are nearly perpendicular to each other. Details of the structure cannot be given at this stage; but the pyrimidine-ring appears

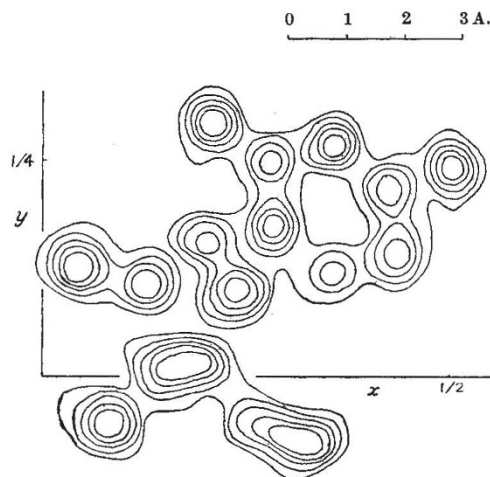


Fig. 1. Fourier projection of cytidine in direction of c -axis

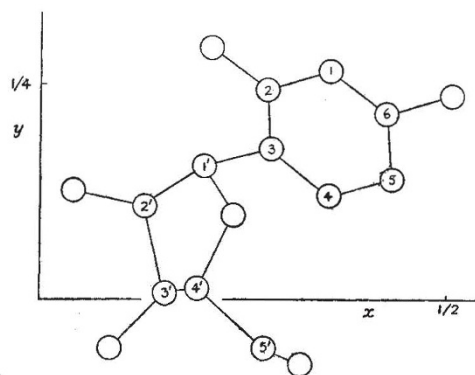


Fig. 2. Molecular projection corresponding to Fig. 1

to be flat, and there is some indication that the ribose-ring may not be planar.

Neighbouring molecules in the crystal are held together by hydrogen bonds.

It is hoped to publish later a more detailed account of the structure.

X-ray work on cytidylic acid is also in progress. The cell-dimensions are $a = 8.74$ A., $b = 21.4$ A., $c = 6.82$ A., and the space-group $P 2_12_12_1$.

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¹ Davoll, Lythgoe and Todd, *J. Chem. Soc.*, 833 (1946).

Runge Bands of O₂ in Flame Spectra

IN a recent note, Hornbeck¹ has reported observing the Runge emission bands of O₂, $^3\Sigma_u^- \rightarrow ^3\Sigma_g^-$, in the spectra of explosion flames of carbon monoxide and oxygen, and has shown that this banded structure is favoured relative to the continuous background by excess of oxygen in the mixture. In a diffusion flame of carbon monoxide burning in oxygen at atmospheric pressure, we have confirmed the presence of the Runge bands, the (0,13), (0,14) and (0,15) bands, with heads at 3233, 3370 and 3516 A., being conspicuous. These bands, however, are emitted by a different part of the flame from the main carbon monoxide flame spectrum, and it is clear that the