Technical Papers

Isomorphism of Terramycin and Aureomycin Hydrochlorides[1]

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Previous x-ray diffraction studies on terramycin hydrochloride in this laboratory (*1*) have established the cell size, space-group, and positions of a number of atoms in terramycin hydrochloride. An earlier report by Dunitz and Leonard (*2*) gave the cell and symmetry of aureomycin hydrochloride. The remarkable similarity of these cells suggested that the two compounds might be isomorphous, particularly since on the basis of published analytical data the two antibiotics might differ chemically only in the replacement of a hydroxyl group in terramycin by a chlorine in aureomycin.

If the two compounds did prove to be isomorphous, it is likely that phases of some Fourier coefficients for the electron density maps could be deduced by intensity comparisons. The presence of the additional chlorine in aureomycin would in any case be likely to provide more phase information than would be available from the terramycin measurements.

We have consequently taken single-crystal x-ray patterns of aureomycin hydrochloride and compared these with those previously obtained here for terramycin. The similarity in scattering is striking, and clearly establishes the isomorphism. The crystallographic constants are compared in Table 1.

TABLE 1

CRYSTALLOGRAPHIC COMPARISON OF TERRAMYCIN · HCl AND AUREOMYCIN · HCl

	Terramycin · HCl ($C_{22}H_{24}N_2O_9 \cdot HCl$) [*3*]	Aureomycin · HCl ($C_{22}H_{23}N_2O_8Cl \cdot HCl$)[2]
a	11.19	11.20 ± 0.02
b	12.49	12.89 ± 0.04
c	15.68	15.47 ± 0.02
Space group	$P2_12_12_1$	$P2_12_12_1$
d	1.51	1.5287
Mol wt (chemical)	496.7	515.1*
Mol wt (x-rays)	499 ± 5	514.5†

* Assuming Cl replacing OH of terramycin.
† The molecular weight calculated by Dunitz and Leonard (*2*) does not correspond with the formula they suggest and differs from our own determination.

The molecular weights determined from x-ray and density measurements are compatible with the assumed aureomycin formula.

Three-dimensional x-ray scattering data have been collected for aureomycin · HCl, using CuKα radiation and a Weissenberg camera, just as was done previously for terramycin · HCl. Comparison of Patterson projections for the two compounds, computed on X-RAC, has established the probable coordinates for the chlorine in aureomycin, which apparently replaces the hydroxyl in terramycin. Three-dimensional analyses are in progress. Location of the two chlorines per molecule, and probable location of some 11 lighter (nonhydrogen) atoms in terramycin, by the vector convergence density technique, now render the x-ray study very promising.

The isomorphism of these two compounds is not merely extremely helpful in the x-ray structure analysis; but poses intriguing problems in microorganism metabolism and antibiotic activity.[2]

[1] Development supported by Office of Naval Research, Contract No. N6onr26916, T. O. 16, and by a research grant from Chas. Pfizer & Co., Brooklyn, N. Y.

References

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Manuscript received February 11, 1952.

[2] A private communication from J. D. Dunitz, received after this note was submitted for publication, reported a parallel observation of this isomorphism.

Physiology of an Infrared Receptor: The Facial Pit of Pit Vipers

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Noble and Schmidt (*1*) in 1937 showed that the sense organ in the facial pit of blindfolded crotalids—rattlesnakes, copperheads, and moccasins—mediates the ability to strike correctly at moving objects such as a dead rat or a cloth-wrapped light bulb and to distinguish between warm and cold ones. They attempted to describe its sensitivity in terms of the reading of a mercury thermometer in the air at the position of the snake's head. However, it seems indicated by their conditions that radiant energy was the effective stimulus. We have undertaken to find out what can be learned of the function of this organ by recording activity from its nerves. The present paper is a preliminary report based on multi-unit analysis.

Specimens of several species of *Crotalus* have been curarized, and the superficial branch of the superior maxillary division of the trigeminal nerve has been exposed, tied, and cut proximally and lifted on electrodes. This is one of three nerves, all from the fifth cranial, ramifying in the thin membrane of the pit organ (*1, 2*). Equally good results have been obtained by a microneedle inserted into the membrane itself.

The nerve proves to be one of those afferents which carry a continuous barrage of impulses in the absence