loses a considerable portion of its label when treated with mercaptoethanol. This effect is shown in the last column of the table.

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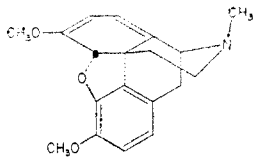
THE STRUCTURE OF PHENOLIC DIHYDROTHEBAINE AND OF β-DIHYDROTHEBAINE

Sir:

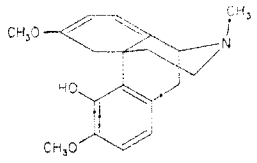
Thebaine (I) gives with sodium and alcohol,[1,2] as well as with sodium and liquid ammonia,[3] a phenolic dihydro compound, called phenolic dihydrothebaine, to which structure II has been assigned. This formulation is not compatible with the ultraviolet absorption spectrum of the compound which shows the low extinction coefficient associated with the guaiacol system ($\lambda_{max.}$ 282 mμ, log ε 3.3) without the additional presence of a conjugated alkoxydiene (compare thebaine hydrochloride, $\lambda_{max.}$ 283 mμ, log ε 3.8). The formation of a conjugated diene in good yield by a sodium and alcohol reduction is also not in accord with expectations.

The infrared absorption spectrum of phenolic dihydrothebaine has now been recorded and allows the assignment to the substance of structure III. This spectrum shows two sharp very characteristic bands at 5.9 and 6.0 μ which have been shown in this Laboratory to be characteristic of the unconjugated dihydroanisole system, while there is no band associated with the 1-alkoxy-1,3-diene between 6.1 and 6.2 μ. The new structure obviously fits all the accumulated data on the chemistry of the compound but requires interchange of the structures assigned[2] to "$\Delta^{5,6}$-dihydrothebainone methyl enolate" and "$\Delta^{6,7}$-dihydrothebainone enol methyl ether."

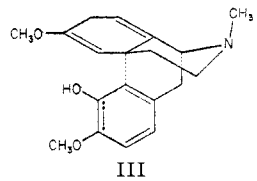
Recently, Schmid and Karrer[4] have proposed that the lithium aluminum hydride reduction product of thebaine, also a phenolic dihydro compound, which they called β-dihydrothebaine has structure IV with the unnatural configuration at C_{14}.



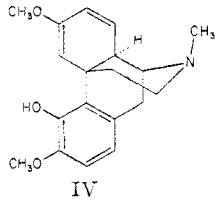
I



II



III



IV

This view is difficult to reconcile with the stereochemistry of thebaine or the formation of dihydrothebainol-6-methyl ether on further catalytic hydrogenation. It is indeed apparent that Schmid and Karrer's substance has the structure formerly assigned to phenolic dihydrothebaine and is II, a fact in accord with the ultraviolet spectrum of the compound ($\lambda_{max.}$ 284 mμ, log ε 4.05). In agreement with this view it has now been found that the substance shows the same infrared spectrum as thebaine in the relevant region.

(1) M. Freund and C. Holtoff, *Ber.*, **32**, 168 (1899).
(2) L. Small and G. L. Browning, *J. Org. Chem.*, **3**, 618 (1939).
(3) K. W. Bentley and R. Robinson, *Experientia*, **6**, 363 (1950).
(4) H. Schmid and P. Karrer, *Helv. Chim. Acta*, **33**, 863 (1950).

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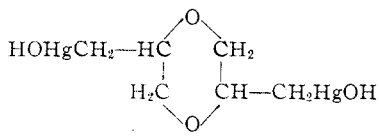
A DIMER OF HUMAN SERUM ALBUMIN WITH A BIFUNCTIONAL MERCURY COMPOUND

Sir:

A bifunctional organic mercurial[1] of the formula



has been successfully employed to link together two molecules of mercaptalbumin, a protein first isolated as a mercury dimer by reaction with mercuric chloride.[2,3] For brevity we denote the protein as AlbSH and the mercurial as HoHg-RHgOH. By light scattering measurements[4] and ultracentrifugal analysis,[5] evidence has been obtained that the reaction proceeds by the following scheme:

$$\text{AlbSH} + \text{HOHgRHgOH} \rightleftharpoons \text{AlbSHgRHgOH} + \text{H}_2\text{O} \quad (1)$$

$$\text{AlbSHgRHgOH} + \text{AlbSH} \rightleftharpoons \text{AlbSHgRHgSAlb} + \text{H}_2\text{O} \quad (2)$$

Turbidity measurements of a 1% solution of mercaptalbumin at *p*H 4.75 and Γ/2 0.05 showed a rapid increase to 1.8–1.9 times the initial value, within three minutes after the addition of 0.5 mole of the mercurial per mole of mercaptalbumin. This indicates that the total reaction described by steps 1 and 2 proceeds much more rapidly than the corresponding reaction of AlbSH with $HgCl_2$, which requires many hours to reach equilibrium.[6] Subsequent ultracentrifugal analysis showed a single boundary sedimenting faster than normal serum albumin (s = 4.6 S) and comparable to the analogous mercury dimer (s = 6.5 S).[3] The reaction proceeded more slowly at *p*H 6. Dimer formation was reversed, in part or completely, by reagents competing for the mercurial, such as sul-

(1) For preparation and proof of structure see: E. Biilmann, *Ber.*, **33**, 1641 (1900); *ibid.*, **35**, 2587 (1902); and J. Sand, *ibid.*, **34**, 1385 (1901).
(2) W. L. Hughes, Jr., THIS JOURNAL, **69**, 1838 (1947).
(3) W. L. Hughes, Jr., "Protein Mercaptides," *Cold Spring Harbor Symposia on Quantitative Biology*, **XIV**, 79 (1950).
(4) For method see: J. T. Edsall, H. Edelhoch, R. Lontie, and P. R. Morrison, THIS JOURNAL, **72**, 4641 (1950).
(5) Ultracentrifugal analyses were carried out by C. Gordon, and computed by Miss V. Gossard, under the supervision of Dr. J. L. Oncley.
(6) W. L. Hughes, Jr., R. Straessle, H. Edelhoch and J. T. Edsall, Abstracts of Papers, 117th Meeting of the American Chemical Society, 1950, 51C.