

amide, the method described in the previously published paper (4) was used.

The  $R_f$  values for the  $N^4$ -substituted sulfonamide official in the U.S.P. XVI (5) and N.F. XI (6), namely I, II, and III were sufficiently different to permit identification

The  $R_f$  values for IV, V, and VI were also sufficiently different to allow separation from each other. Of the six compounds tested, all can be separated either by  $R_f$  values or fluorescent observation, except I and V. At equal concentrations of 1 mcg. per spot, V is not visible. Though II and IV give close  $R_f$  values, II changes the indicator color to blue or purple whereas IV does not. Compound IV gives a bright blue fluorescence and II does not.

After two days the standard solutions showed the presence of the free form.

Due to the uncertainty of reproducing  $R_f$  values from one plate to another, it is important to use standards along with the samples.

The total development time is approximately two and one-half hours.

#### REFERENCES

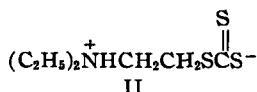
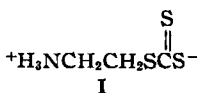
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## Communications

### Structure of the Carbon Disulfide Adduct of $\beta$ -Mercaptoethylamine

Sir:

We have recently reported (1, 2) the preparation of a compound from the reaction of  $\beta$ -mercaptoethylamine (MEA) and carbon disulfide, in either aqueous or alcoholic ammonia, which gave good protection to animals against an otherwise lethal dose of X-irradiation. This compound was believed to be 2-mercaptoethylthiocarbamic acid on the basis of elemental analysis, its reaction with acylating agents, and a characteristic dithiocarbamate absorption peak (3) in the ultraviolet at  $248 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 3.03$ ) ( $\text{C}_2\text{H}_5\text{OH}$ ). Other characteristic absorption peaks for dithiocarbamates at  $290\text{--}310 \text{ m}\mu$  and  $340\text{--}360 \text{ m}\mu$  were absent, however, and further examination of the ultraviolet absorption characteristics of dithiocarbamate and trithiocarbonate zwitterions has shown the product in question to be a trithiocarbonate zwitterion I. A previous example of a trithiocarbonate zwitterion has not appeared in the literature.



Trithiocarbonate zwitterion II of unquestioned structure was prepared from 2-diethylamino-

ethanethiol hydrochloride (Evans Chemetics, Inc.) and carbon disulfide in ammoniacal solution, analogously to the preparation of I, m.p.  $114\text{--}115^\circ$  with effervescence, (90% yield).

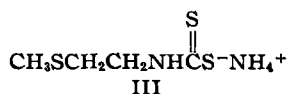
*Anal.*—Calcd. for  $\text{C}_7\text{H}_{15}\text{NS}_3$ : C, 40.16; H, 7.22; N, 6.70; S, 45.94. Found: C, 40.74; H, 7.20 N, 6.96; S, 46.13.

The compound reduced iodine, and it showed definite trithiocarbonate absorption peaks (4) in the ultraviolet at  $226 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 4.07$ ) and  $303 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 4.18$ ) in alkaline  $\text{C}_2\text{H}_5\text{OH}$ . Compound I, quite similar in color and physical appearance, showed ultraviolet absorption peaks at  $226 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 3.96$ ) and  $304 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 4.15$ ), when observed in the same solvent.

Furthermore, compound III, possessing definite dithiocarbamate absorption characteristics in the ultraviolet, was prepared from the S-methyl ether of MEA [prepared by the procedure of Gonick (5)] and carbon disulfide in ammoniacal solution, and was isolated as an unstable ammonium salt, m.p.  $104\text{--}106^\circ$ , (70% yield).

*Anal.*—Calcd. for  $\text{C}_4\text{H}_{12}\text{N}_2\text{S}_3$ : N, 15.27; S, 52.17. Found: N, 15.06; S, 51.38.

Loss of ammonia and carbon disulfide was evident within 24 hours. Characteristic dithiocarbamate absorption was observed at  $257 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 3.92$ ),  $292 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 4.06$ ), and  $345 \text{ m}\mu$  ( $\log \epsilon \text{ max.} = 1.95$ ) in alkaline  $\text{C}_2\text{H}_5\text{OH}$ .



Because of the remarkable agreement in physical properties and ultraviolet absorption between the carbon disulfide adduct I of MEA and a similarly constituted trithiocarbonate

zwitterion on the one hand, and the marked disparity in these properties with the dithiocarbamate of the methyl thioether of MEA on the other, it is concluded that I is a trithiocarbonate zwitterion.

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## Alkaloids of *Vinca rosea* Linn. (*Catharanthus roseus* G. Don) XVIII. Root Alkaloids

Sir:

A number of crude amorphous alkaloidal fractions from root extracts had demonstrable anti-P-1534 leukemia activity in DBA/2 mice, and it was deemed necessary to determine whether this oncolytic activity was caused by any of the four known dimeric alkaloids or by any new entities. While the roots had been examined previously by other investigators (1), they had not been looked at utilizing the method of selective extraction, followed by column chromatography and gradient pH techniques as devised in this laboratory (2, 3).

The *A* fraction yielded two new alkaloids, vinosidine and lochnerivine, as well as mitraphylline (the oxindole of ajmalicine)—first reported as being obtained from *Mitragyna macrophylla* Hiern (4)—along with varying amounts of the known alkaloids ajmalicine, leurosine, virosine, perivine, VLB (obtained as both base and sulfate), leurosidine, carosidine, sitsirikine (as sulfate), and trace amounts of leurocristine (as sulfate) (5). Two other new alkaloids, leurosivine and cavincine, were obtained only as sulfates.

The *B* fraction gave three new alkaloids, amocalline,<sup>1</sup> pericalline, and ammososine, as well as akuammicine [first reported as being obtained from *Picralima klaineana* Pierre (6)], along with lochnerivine, leurosine, perivine, virosine, and lochnerine.

Pertinent physical data of these new alkaloids are as follows:

WILLIAM O. FOYE  
JAMES R. MARSHALL†  
JAMES MICKLES

Department of Chemistry  
Massachusetts College of Pharmacy  
Boston 15, Mass.

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† Fellow of the American Foundation for Pharmaceutical Education.

Vinosidine crystallized from methanol, m.p. 253–257° dec.;  $pK'a = 6.80$  (33% DMF).

*Anal.*—Calcd. for  $C_{22}H_{26}N_2O_6$ : C, 66.31; H, 6.58; N, 7.03; O, 20.08. Found: C, 66.26; H, 6.72; N, 6.75; O, 20.51.

The ultraviolet spectrum in ethanol is characterized by maxima at 226, 254, 259, and 300  $m\mu$ , with a shoulder at 330  $m\mu$ ;  $\log E$  (1%, 1 cm.) = 3.01, 2.46, 2.46, 2.20, and 1.90, respectively. The infrared spectrum of a  $CHCl_3$  solution exhibits the following 11 characteristic bands, listed in the order of decreasing intensities (as in all following examples): 1220, 1299, 1266, 1282, 1538, 1695, 1149, 1136, 1724, 1471, and 1087  $cm^{-1}$ .

Lochnerivine crystallized from methanol, m.p. 278–280°; no titratable groups were found between pH 3.0–11.0.

*Anal.*—Calcd. for  $C_{24}H_{28}N_2O_5$ : C, 67.90; H, 6.65; N, 6.60; O, 18.85. Found: C, 67.91; H, 6.48; N, 7.01.

The ultraviolet spectrum in ethanol is characterized by maxima at 296 and 329  $m\mu$ , with a shoulder at 236  $m\mu$ ;  $\log E$  (1%, 1 cm.) = 2.52, 2.61, and 2.39, respectively. The infrared spectrum of a Nujol mull shows the following bands: 1666, 1615, 1685, 1464, 1640, 1453, 1200, 1380, 1113, 1168, and 1369  $cm^{-1}$ .

Leurosivine crystallized as the sulfate from ethanol, m.p. > 335° dec.;  $pK'a = 4.8, 5.8$  (33% DMF).

*Anal.*—Calcd. for  $C_{41}H_{54}N_3O_9 \cdot H_2SO_4$ :<sup>2</sup> C, 59.26; H, 6.79; N, 5.06; S, 3.86; O, 25.03. Found: C, 59.00; H, 6.85; N, 5.09; S, 3.71; loss on drying, 4.5.

The ultraviolet spectrum in ethanol is characterized by maxima at 214 and 265  $m\mu$ , with shoulders at 286, 295, and 310  $m\mu$ ;  $\log E$  (1%,

<sup>1</sup> Small's genus *Ammocallis* is a synonym of *Vinca*, but this segregated genus is not accepted as replacing *Vinca*. The name *Ammocallis rosea* Small is a straight synonym for *Vinca rosea* Linn.

<sup>2</sup> Although this molecular formula agrees well with the analytical results, previous experience with the dimeric alkaloids shows a tenacious solvent retention. This formula must be considered as proximate at this time.