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Reaction of 1,2-dibromoethane with 2-mercaptoadenine gave both 4-amino-7,8-dihydrothiazolo[2,3-*b*]purine (**2**) and the isomeric 3,6,7,9-tetrahydro-9-iminothiazolo[3,2-*a*]purine (**3**). These tricyclic structures were identified by Raney nickel reduction to the corresponding 3- and 1-ethyladenines.

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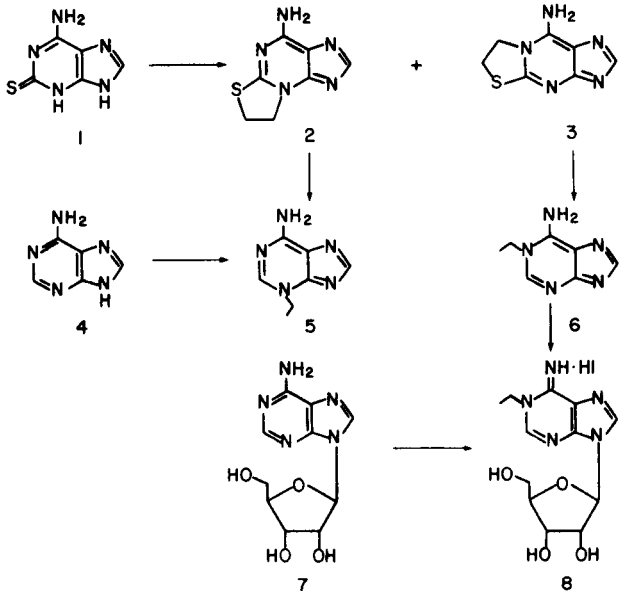
The reaction of purine-2-(1 or 3*H*)thione with 1-bromo-2-chloroethane gave 2-(2-chloroethylthio)purine which cyclized at N-3 on heating to give 7,8-dihydrothiazolo-[2,3-*b*]purine exclusively (1). In connection with other work it became of interest to determine the effect of an amino group at C-6 on this cyclization reaction, since in neutral media, adenine itself is alkylated primarily at N-3 but significant amounts of the N-1 isomer are also formed (2,3).

It was, therefore, not surprising that the reaction of 6-aminopurine-2-(1 or 3*H*)thione (2-mercaptoadenine) (4) with 1,2-dibromoethane gave a mixture of two products that could be separated by their solubility differential in chloroform. The major product, obtained in 36% yield, by chloroform extraction, was identified as 4-amino-7,8-dihydrothiazolo[2,3-*b*]purine (**2**) by dethiolation with Raney nickel to 3-ethyladenine (5), prepared also by the ethylation of adenine. The minor product, 3,6,7,9-tetrahydro-9-iminothiazolo[3,2-*a*]purine (**3**), obtained as a partial hydrobromide in 21% yield from the chloroform insoluble residue, was also dethiolated to give a compound identified as 1-ethyladenine by comparison with an authentic sample prepared by the ethylation of adenosine, which is known to alkylate primarily at N-1 (6).



EXPERIMENTAL

All evaporations were carried out *in vacuo* with a rotary evaporator. Analytical samples were normally dried *in vacuo* over phosphorus pentoxide at room temperature for 16 hours. Analtech precoated (250 μm) silica gel G (F) plates were used for tlc analyses; the spots were detected by irradiation with a Mineralight and by charring after spraying with saturated ammonium sulfate. Compounds containing amino groups were also detected with ninhydrin spray. All analytical samples were essentially tlc homogeneous. Melting points were determined with a Mel-Temp apparatus and are not corrected. The uv absorption spectra were determined in 0.1 *N* hydrochloric acid, *p*H 7 buffer, and 0.1 *N* sodium hydroxide with a Cary 17 spectrophotometer: the maxima are reported in nm ($\epsilon \times 10^{-3}$).

The Reaction of 2-Mercaptoadenine (**1**) with 1,2-Dibromoethane.

A suspension of 2-mercaptoadenine (**1**, 225 mg., 1.35 mmoles) and potassium carbonate (186 mg., 1.35 mmoles) in 50 ml. of DMAC containing 1,2-dibromoethane (0.22 ml., 2.7 mmoles) was heated at 40° for 18 hours before it was evaporated to dryness and the residue triturated with EtOH which was removed by evaporation. The white residue was extracted for 2 days with chloroform, which was removed and evaporated to dryness. The residue crystallized from methanol, yield 93 mg. (36%) of 1,4,7,8-tetrahydro-4-iminothiazolo[2,3-*b*]purine (**2**). It was recrystallized from methanol to obtain the analytical sample, yield 48 mg., m.p. > 300°; uv (*p*H 1): 247, 292 (ε 25.4, 11.3); (*p*H 7, 13): 238, 294 (ε 27.6, 11.6).

Anal. Calcd. for $C_7H_7N_5S$: C, 43.51; H, 3.65; N, 36.26. Found: C, 43.49; H, 3.88; N, 36.01.

The filtrate from the isolation of **2** gave 28 mg. of a white solid shown by tlc to be an approximately 1:1 mixture of **2** and **3**.

The chloroform insoluble material was crystallized from EtOH-H_2O, yield 73 mg. (21%) of a partial hydrobromide of 3,6,7,9-tetrahydro-9-iminothiazolo[3,2-*a*]purine (**3**) which was dissolved in hot water (7 ml.) and the *p*H of the solution raised to 8-9 with concentrated ammonium hydroxide. The material that crystallized on scratching was recrystallized from ethanol-water, yield 32 mg., m.p. 305-310 dec.; uv (*p*H 1): 224, 271 (ε 14.9, 14.7); (*p*H 13): 277, 287 sh (ε 14.8, 10.5).

Anal. Calcd. for $C_7H_7N_5S$: C, 43.51; H, 3.65; N, 36.26. Found: C, 43.28; H, 3.89; N, 35.97.

3-Ethyladenine (**5**).

A solution of 1,4,7,8-tetrahydro-4-iminothiazolo[2,3-*b*]purine (**2**) (138 mg., 0.7 mmole) in methanol (40 ml.) containing Raney nickel (*ca.* 60 mg.) was refluxed for 5 hours before the catalyst was removed by filtration and the filtrate evaporated to dryness. The residue was recrystallized from ethanol, yield 23 mg. (20%), m.p. 231-233° (lit. (5) 233°); uv (*p*H 1): 274 (ε 15.3); (*p*H 7, 13): 273 (ε 12.1).

Anal. Calcd. for $C_7H_9N_5$: C, 51.51; H, 5.56; N, 42.92. Found: C, 51.77; H, 5.52; N, 42.82.

1-Ethyladenine Hydrobromide (**6**).

A. A solution of 1-ethyladenosine hydroiodide (**8**) (150 mg., 0.36 mmole) in 50 ml. of 5% hydrobromic acid was refluxed for 10 minutes, cooled, and neutralized with 1 *N* sodium hydroxide before it was concen-

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trated to about 3 ml. and chilled. The solid that crystallized was converted to the hydrobromide and recrystallized from ethanol-water, yield 20 mg. (24%), m.p. >260°; uv (*p*H 1): 259 (ε 12.1); (*p*H 7): 267 (ε 11.3); (*p*H 13): 272 (ε 14.6).

Anal. Calcd. for $C_7H_{10}BrN_5 \cdot \frac{1}{4}H_2O$: C, 33.81; H, 4.26; N, 28.17. Found: C, 33.73; H, 4.42; N, 28.20.

B. A solution of 3,6,7,9-tetrahydro-9-iminothiazolo[3,2-*a*]purine (**3**) (90 mg., 0.47 mmole) in 150 ml. aqueous methanol containing 60 mg. Raney nickel was refluxed for 30 hours before the catalyst was removed by filtration from the hot solution and washed with methanol and water. Evaporation of the combined filtrate and wash gave a residue which was converted to the hydrobromide salt and crystallized from ethanol, yield, 20 mg. Its properties were essentially identical to those given above for the 1-ethyladenine hydrobromide.

1-Ethyladenosine Hydroiodide (**8**).

A solution of adenosine (534 mg., 2 mmoles) and ethyl iodide (3.12 g., 20 mmoles) in DMAC (50 ml.) was stirred for 78 hours at ambient temperature and heated at 78° for 18 hours before it was concentrated to *ca.* 10 ml. and acetone (60 ml.) added. The crystalline material that formed (540 mg., 64%) was recrystallized from ethanol, yield 365 mg., m.p. 208-209°; uv (*p*H 1, 7): 258 (13.4); (*p*H 13): 259, 267 sh. (13.8, 12.1).

Anal. Calcd. for $C_{12}H_{18}IN_5O_4$: C, 34.06; H, 4.29; N, 16.55. Found: C, 34.29; H, 4.49; N, 16.64.

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