polymer was condensed with protected nucleotide bis(triethylammonium) salt in the presence of 2,4,6-triisopropylbenzenesulfonyl chloride as previously described.[3b] Products containing only pyrimidines were released from the polymer by agitation for 5 hr with HOAc–H_2O–C_6H_6 (16:4:5, v/v) while those containing purines were acid treated for only 15 min and immediately freed of acid by rapid evaporation under vacuum in a rotary evaporator at room temperature. The dried crude products were then hydrolyzed for 48 hr in pyridine–concentrated NH_4OH (1:3, v/v) and paper chromatographed.

For the trinucleoside diphosphate preparations of Tables II and III, 3′-O-deacetylation was effected with 0.2 *M* KOH in methanol–dioxane (1:9, v/v) as described previously.[3b] For the preparations in Table IV an equivalent amount of 0.2 *M* crown ether–KOH complex in benzene[18] was used as the hydrolysis medium and the polymer was washed exhaustively with benzene, pyridine, and methanol, then dried prior to the second nucleotide condensation.

Enzymic Hydrolyses.—The purified oligonucleotides were hydrolyzed with spleen and venom phosphodiesterases as previously described;[3b] the results are summarized in Table V.

Registry No.—Deoxyadenylyl-(3′→5′)-thymidylyl-(3′→5′)-thymidine, 17862-43-0; deoxyguanylyl-(3′→5′)-thymidylyl-(3′→5′)-thymidine, 17853-31-5; deoxycytidine–thymidine oligomers, 17853-32-6.

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Pyrimidine Nucleosides. III. Nucleoside Derivatives of Certain 4-Substituted 6-Pyrimidones[1]

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The synthesis of 4,6-disubstituted pyrimidine nucleosides possessing two hydrogen-bonding groups has been achieved for the first time using a modified Hilbert–Johnson procedure. 4-Amino-1-(β-D-ribofuranosyl)-6-pyrimidone (**8**) and 4-amino-1-(2-deoxy-β-D-ribofuranosyl)-6-pyrimidone (**9**) have been prepared by direct utilization of 4-amino-6-pyrimidone (**5**) *via* silylation and subsequent treatment with the appropriate glycosyl halide in acetonitrile. This procedure applied to 4-methylthio-6-pyrimidone gave 4-methylthio-1-(β-D-ribofuranosyl)-6-pyrimidone (**2**). Reductive desulfurization of **2** gave 1-(β-D-ribofuranosyl)-6-pyrimidone (**3**). Oxidation of a blocked derivative of **2** provided the corresponding methyl sulfone **7** which was successfully converted into **8** and also into 4-methoxy-1-(β-D-ribofuranosyl)-6-pyrimidone (**6**).

The success achieved in the preparation of pyrimidine nucleosides *via* the silylation and alkylation procedures[2,3] suggested the possible extension of this work to 4-substituted 6-pyrimidones. Although the Hilbert–Johnson procedure has recently been successfully employed in the case of 4,6-dimethoxypyrimidine[4] to yield 4-methoxy-1-(β-D-ribofuranosyl)-6-pyrimidone (**6**), the methoxy group could not be successfully changed to other substituents. Attempts to prepare the corresponding 2-deoxy-β-D-ribofuranosyl derivative by the Hilbert–Johnson procedure gave only 0.67% of desired product.[4] A recent paper[5] describes the use of the mercuri procedure for ribosylation of 4-substituted 6-pyrimidones. In most cases the *O*-glycosyl derivatives were found to predominate in a mixture of *O*- and *N*-ribosylated products. The use of acetonitrile, however, gave predominately *N*-ribofuranosyl derivatives.

In the present study 4-amino-6-pyrimidone[6] **5** was treated with hexamethyldisilazane to give the trimethylsilyl derivative which was in turn treated directly in acetonitrile with 2,3,5-tri-*O*-benzoyl-D-ribofuranosyl bromide. The product obtained after work-up and purification on silica gel was 4-amino-1-(2,3,5-tri-*O*-benzoyl-β-D-ribofuranosyl)-6-pyrimidone (**10**) (Scheme I). Deblocking of crude **10** with methanolic ammonia gave 4-amino-1-(β-D-ribofuranosyl)-6-pyrimidone (**8**) in 61% over-all yield. The physical properties of **8** agree with those recorded by Prystas[5] for this compound prepared by the mercuri procedure. Reaction of **12** with 2-deoxy-3,5-di-*O*-*p*-toluyl-D-ribofuranosyl chloride[7] in acetonitrile yielded after purification by alumina column chromatography a 75% yield of a syrupy mixture of blocked anomers (**11** and **11a**). Deblocking of this material with methanolic ammonia gave a 75% yield of a crystalline mixture of anomers **9** and **9a**. 4-Amino-1-(2-deoxy-α-D-ribofuranosyl)-6-pyrimidone (**9a**) was isolated from this mixture by fractional crystallization. 4-Amino-1-(2-deoxy-β-D-ribofuranosyl)-6-pyrimidone (**9**) was isolated from the mother liquors enriched in **9** by preparative tlc with silica gel adsorbent. The assignment of configuration was readily made by a comparison of the pmr of **9** and **9a** measured in deuterium oxide with an internal standard of sodium 2,2-dimethyl-2-silapentane-5-sulfonate. The anomeric proton of **9** exhibited a pseudotriplet centered at 6.27 ppm (width 13.2 cps, $J_{1',2'}$ = 6.6 cps). The anomeric proton of **9a** consisted of a multiplet of four peaks centered at 6.20 ppm (width 9.3 cps, "$J_{H1'}$" = 2.3 and 7.0 cps). These data clearly allow assignment[8-11] of **9** as the β-D anomer and **9a** as the α-D anomer. The ratio of the anomers **9a**:**9** obtained by this silylation and alkylation procedure was approxi-

(1) This work was supported by Research Grants CA-08109-02 and -03 from the National Cancer Institute of the National Institutes of Health, U. S. Public Health Service, Bethesda, Md.

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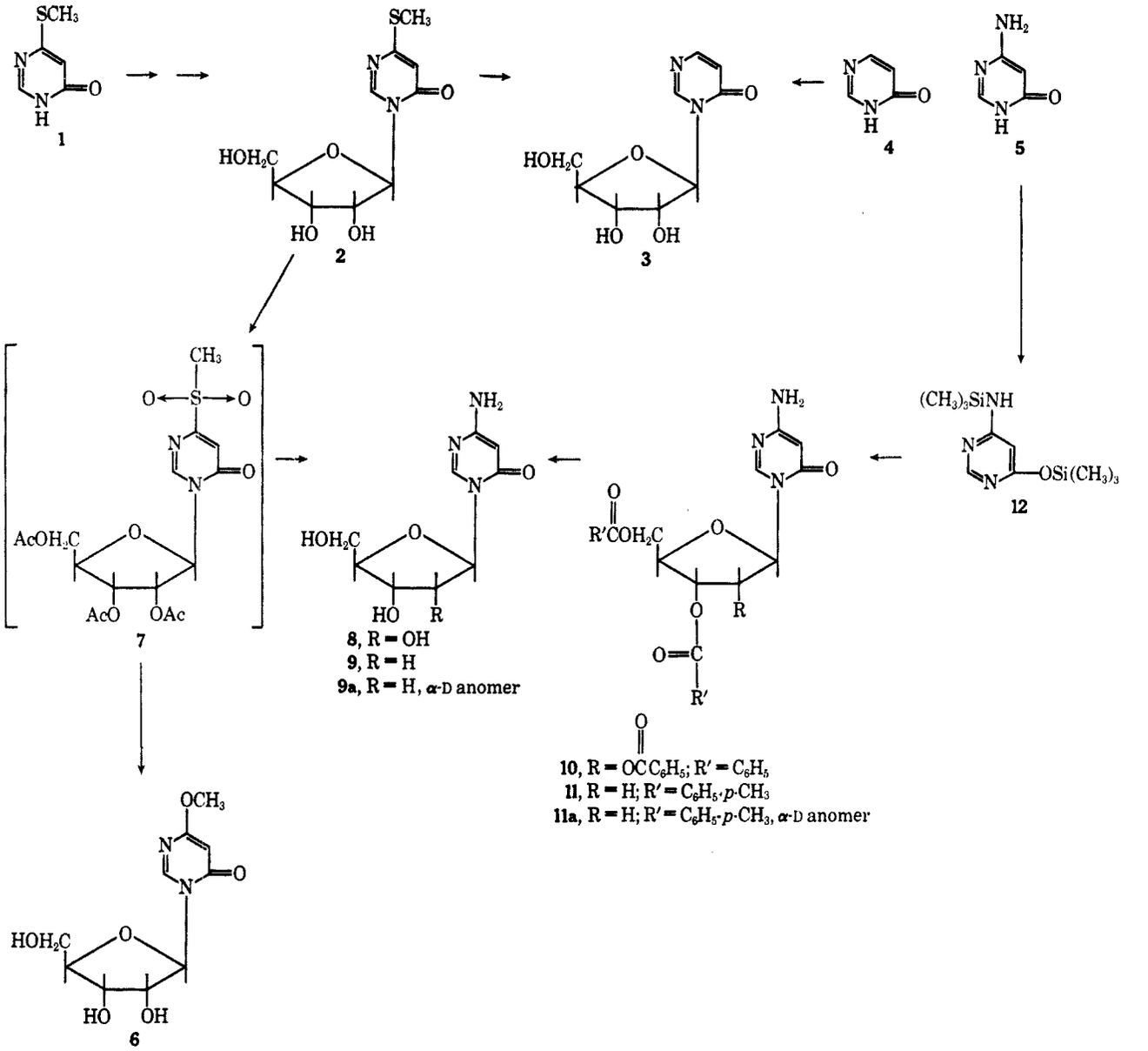
SCHEME I



mately 10:1 based on isolated products. This result is in contrast to our earlier findings[12] where the β-D anomer of 6-methyl-2′-deoxycytidine was found to be the predominant anomer using this same procedure. 4-Methylthio-6-pyrimidone[13] **1** was converted into its trimethylsilyl derivative and allowed to react with 2,3,5-tri-*O*-acetyl-D-ribofuranosyl bromide in acetonitrile. After work-up and purification by alumina column chromatography the syrupy blocked nucleoside was deblocked with methanolic ammonia to give a 15% yield of 4-methylthio-1-(β-D-ribofuranosyl)-6-pyrimidone (**2**). Treatment of **2** with sponge nickel in 2-methoxyethanol produced the known 1-(β-D-ribofuranosyl)-6-pyrimidone[14,15] (**3**) made by the procedure of Pfleiderer and Robins.[15] This conversion established directly the structure assigned to compound **2**.

Compound **2** was acetylated with acetic anhydride–pyridine and the resulting syrupy blocked nucleoside was oxidized with *m*-chloroperbenzoic acid in chloroform to give amorphous 4-methylsulfonyl-1-(2,3,5-tri-*O*-acetyl-β-D-ribofuranosyl)-6-pyrimidone (**7**). Treatment of **7** with liquid ammonia at 80° resulted in a 55% yield of **8**. The sequence **2** → **7** → **8** thus established unequivocally the structure of the nucleoside 4-amino-1-(β-D-ribofuranosyl)-6-pyrimidone (**8**) produced *via* the sequence **5** → **12** → **10** → **8**.

Reaction of **7** with sodium methoxide in methanol at room temperature gave 4-methoxy-1-(β-D-ribofuranosyl)-6-pyrimidone **6** in 48% yield. Prystas[4] reported mp 77–81° for **6** made from 2,4-dimethoxypyrimidine *via* a Hilbert–Johnson procedure. Our product **6** exhibited mp 129–130°. This discrepancy would appear to be due to an ethanol solvation of Prystas' product. It is of interest to note that compound **7** when treated with methanolic ammonia at room temperature or at elevated temperatures gives rise to both compounds **8** and **6** and that **6** is produced in much larger yield than **8**.

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Compounds **8** and **9** are analogs of cytidine and deoxycytidine, respectively, and as such should be of interest in biochemical studies. A very similar analog, 5-azacytidine,[16] has been shown to be incorporated into both RNA and DNA.[17] In effect compound **8** could be viewed as "3-deaza-5-azacytidine."

Experimental Section

Melting points were determined with a Thomas–Hoover capillary melting point apparatus and are uncorrected. Specific rotations were measured in a 1-dm tube with a Perkin-Elmer Model 141 automatic digital readout polarimeter. Proton magnetic resonance (pmr) spectra were measured with appropriate internal standards of tetramethylsilane or sodium 2,2-dimethyl-2-silapentane-5-sulfonate with a Varian A-60 nmr spectrometer. Ultraviolet spectra were determined with a Beckmann DK-2 spectrophotometer. Infrared spectra were determined with a Beckman IR-5 spectrophotometer. Detection of components on SilicAR 7GF (Mallinckrodt) and alumina HF 254 (Brinkmann) was by ultraviolet light. Alumina used in columns was obtained from Merck and Co. (suitable for chromatographic absorption). Silica gel was purchased from J. T. Baker Chemical Co. (suitable for chromatographic use). Solvent proportions were by volume. Evaporations were performed under diminished pressure at 35° with a Buchi Rotovapor.

Trimethylsilyl derivatives of various pyrimidines were prepared using the general procedure of Wittenburg.[18] The pyrimidines were heated under reflux in an excess of hexamethyldisilazane with a catalytic quantity of ammonium sulfate under anhydrous conditions until complete solution was achieved. The time of heating varied from 1 or 2 hr to approximately 3 days. The excess hexamethyldisilazane was removed by distillation under diminished pressure and the residue (oil or crystalline solid) was used directly without further purification.

4-Amino-1-(β-D-ribofuranosyl)-6-pyrimidone (8). Method 1.—To the crystalline bistrimethylsilyl derivative of 4-amino-6-pyrimidone **12** (prepared from 20 g of 4-amino-6-pyrimidone[6]) was added 2,3,5-tri-*O*-benzoyl-D-ribofuranosyl bromide (prepared from 50 g of 1-*O*-acetyl-2,3,5-tri-*O*-benzoyl-D-ribofuranose) in dry acetonitrile (400 ml). The mixture was sealed and stirred until solution occurred. After 6 days at room temperature the solution was evaporated to a syrup. Excess sodium bicarbonate, water (100 ml), and ethanol (100 ml) were added and the mixture was evaporated to dryness. The remaining traces of water were removed by coevaporation with absolute ethanol. The residue was extracted several times with dichloromethane and the extract evaporated to a syrup. This syrup was extracted once more with dichloromethane and the dichloromethane extract treated with charcoal. The dry syrup obtained upon solvent removal weighed 58.8 g. A portion (48.8 g) of this crude 4-amino-1-(2′,3′,5′-tri-*O*-benzoyl-β-D-ribofuranosyl)-6-pyrimidone (**10**) was dissolved in methanol (300 ml) previously saturated at 0° with ammonia and left in a sealed vessel at room temperature for 3 days. Crystals of **8** were deposited. The solution was allowed to evaporate at room temperature. The crystalline residue was triturated with ethanol to yield 14.8 g (61%), mp 233–236° dec (prior browning at 190°). Recrystallization from water provided 12.6 g (52%) of product: mp 237–239° dec (yellowing at 215°); $[\alpha]^{26}D$ −27.6° (*c* 1, dimethylformamide); $\lambda_{max}^{pH\ 1}$ 257 mμ (ε 7300), $\lambda_{min}^{pH\ 1}$ 237 (3800), $\lambda_{max}^{pH\ 4}$ 257 (6100), $\lambda_{min}^{pH\ 4}$ 237 (3800), $\lambda_{max}^{pH\ 11}$ 257 (6400), $\lambda_{min}^{pH\ 11}$ 235 (3700), $\lambda_{max}^{pH\ 14}$ 257 (6300), $\lambda_{min}^{pH\ 14}$ 242 (5400); pmr (DMSO-d_6) δ 5.09 (s, 1, 5-H), 5.88 (d, 1, $J_{1',2'}$ = 3.5 cps, 1′-H), 6.58 (s, 2, 4-NH_2), 8.37 (s, 1, 2-H); pmr (DMSO-d_6–D_2O) δ 3.70 ppm (s, 2, 5′-CH_2OH).

Anal. Calcd for $C_9H_{13}N_3O_5$: C, 44.44; H, 5.39; N, 17.28. Found: C, 44.38; H, 5.33; N, 17.28.

The compound was homogeneous by tlc on SilicAR 7GF with ethyl acetate–methanol (4:1) as developer. The above data for **8** are similar to those recorded for the same nucleoside prepared *via* the mercuri procedure.[5]

Method 2.—4-Methylthio-1-(β-D-ribofuranosyl)-6-pyrimidone (**2**, 0.75 g) was dissolved in acetic anhydride (15 ml) and pyridine (15 ml) and the solution was left overnight at room temperature. The mixture was poured onto ice and extracted with chloroform. The chloroform solution was washed consecutively three times with 1 *N* hydrochloric acid, twice with water, and twice with saturated sodium bicarbonate solution, and three times with water. The dried ($MgSO_4$) chloroform solution was evaporated to dryness to yield 1.64 g of dry syrup.

To this crude 2′,3′,5′-triacetate in chloroform (10 ml) at −15° was added *m*-chloroperbenzoic acid[19] (1.64 g) in chloroform (30 ml) at −15°. The mixture was stirred initially and allowed to stand at room temperature overnight. The solution was diluted with chloroform and washed consecutively with saturated sodium sulfite solution, twice with ice cold 2 *N* sodium carbonate solution, and twice with water. The dried ($MgSO_4$) chloroform solution was evaporated to give a dry syrup (1.59 g). Thin layer chromatography on SilicAR with ethyl acetate as developer showed that this material was homogeneous and different from starting material. An absorption band at 1320 cm^{-1} (KBr) in the infrared spectrum indicated the presence of a methylsulfonyl group.

A portion (0.65 g) of **7** was dissolved in liquid ammonia (100 ml) and the solution was sealed in a steel bomb and heated at 80° for 8 hr. The ammonia was allowed to evaporate and the semicrystalline residue was triturated with methanol to give 0.20 g (55%) of yellow crystals, mp 231–234° dec. This material was dissolved in hot water and the solution decolorized with charcoal. To the resulting filtrate was added 2-propanol and the solution was cooled to give white crystals, mp 237–239° dec (yellow from 200°). A mixture melting point with **8** prepared by method 1 showed no depression. The infrared spectrum in KBr was also superimposable on that of **8** prepared by method 1.

4-Amino-1-(2,3,5-tri-*O*-benzoyl-β-D-ribofuranosyl)-6-pyrimidone (10).—The remaining portion of crude 4-amino-1-(2′,3′,5-tri-*O*-benzoyl-β-D-ribofuranosyl)-6-pyrimidone (**10**, 10 g) was dissolved in benzene (700 ml) and applied to a column (44 × 3.4 cm) of alumina prepacked in benzene. The material was washed on with benzene (2 l.) and 200-ml fractions were collected from the start of the benzene. Elution was effected with benzene–ethyl acetate (2 l.) followed by ethyl acetate. Fractions (100 ml) were collected from fraction 21. Fractions 24–35 were pooled and evaporated to a syrup which was crystallized from methanol to yield 3.98 g (42%), mp 132–134°. Two recrystallizations from methanol afforded pure material: mp 137–138°; λ_{max}^{KBr} 1725 (C=O of benzoate), 1665 cm^{-1} (C=O, NH_2 of pyrimidine).

Anal. Calcd for $C_{30}H_{25}N_3O_8$: C, 64.85; H, 4.54; N, 7.56. Found: C, 64.80; H, 4.45; N, 7.69.

4-Amino-1-(2-deoxy-αβ-D-ribofuranosyl)-6-pyrimidone.—2-Deoxy-3,5-di-*O*-*p*-toluyl-D-ribofuranosyl chloride[7] (35 g) and Type 4A Molecular Sieves (20 g) and **12** (prepared from 20 g of **5**) were stirred in acetonitrile (500 ml) protected from moisture at 15° for several hours. Solution occurred quickly but later a precipitate formed. The mixture was then stirred at room temperature overnight. The mixture was diluted with chloroform and the solution filtered through Celite. The filtrate was evaporated to a syrup and treated with solid sodium bicarbonate, water and ethanol. The mixture was evaporated to dryness and the residue was extracted with 2 l. of chloroform. The chloroform was removed and the residual syrup extracted once more with chloroform. The crude syrupy mixture of anomeric nucleosides obtained on solvent removal weighed 44.37 g. This material was purified by chromatography on a column of alumina. The mixture was dissolved in chloroform (300 ml) and applied to a column (45 × 5.0 cm) of alumina prepacked in benzene. This material was washed on with benzene (1.5 l.). Elution was started with benzene–ethyl acetate (9:1) and 200-ml fractions were collected from the start of this solvent. At fraction 10 the eluting solvent was changed to benzene–ethyl acetate (4:1), at fraction 20 to benzene–ethyl acetate (3:2), at fraction 37 to benzene–ethyl acetate (1:1) and at fraction 64 to ethyl acetate. Fractions 13–80 inclusive were pooled and evaporated to dryness to give 31.6 g (75%) of purified nucleoside material.

This syrupy material (10 g) was dissolved in ammonia saturated (at 0°) methanol (150 ml) in a pressure bottle and allowed to remain at room temperature for 3 days. The solution was filtered and evaporated to dryness. The residue was extracted with a mixture of water and chloroform. The aqueous

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solution obtained was washed an additional three times with chloroform. The aqueous solution was evaporated to a syrup which was dissolved in methanol and decolorized with charcoal. After solvent removal the remaining syrup was crystallized (seeding) from methanol–ethyl acetate to yield 3.70 g (75%) (mp 166–170°) of a mixture of anomers consisting largely of the α-D anomer. Thin layer chromatography on SilicAR 7GF with ethyl acetate–methanol (9:1) as developer (several times) revealed two spots with almost identical R_f values—a major slower one and a minor faster one.

Fractionation of the Mixture of Anomers.—The anomeric mixture (3.02 g) was dissolved in methanol and the solution was decolorized with charcoal. The solvent was removed and the residual syrup seeded with pure α anomer. Ethanol was added and the solution warmed. The cooled solution gave crystals, 1.64 g (mp 180–182°), of pure α anomer. The filtrate was evaporated to dryness and the process was repeated to give a further 0.32 g of α anomer plus a trace of β anomer. The fractional crystallization was readily followed by tlc on SilicAR 7GF with ethyl acetate–methanol (9:1) as developer. The β anomer ran a little faster than the α anomer. The remaining mother liquor from the above process was judged to be an approximately 1:1 mixture of the α and β anomers. The mother liquor was evaporated to dryness and the crystalline residue was applied to the edge of 14 plates (2 × 200 ×400 mm) of SilicaAR 7GF and the plates were developed three times using ethyl acetate–methanol (9:1) as solvent. The anomers were clearly separated. The zones were excised and the separated anomers were extracted with methanol. The solvent was removed and the residual individual syrups were coevaporated with absolute ethanol. The two residues were extracted with a mixture of hot absolute methanol and absolute ethanol and the solution concentrated separately to yield 0.22 g (mp 194–196°) of crystalline β anomer 9 and 0.13 g of crystalline α anomer (mp 181–182°).

Recrystallized α anomer exhibited the following characteristics: mp 182–184°; $[\alpha]^{25}D$ −15.4° (*c* 1, water); $\lambda_{max}^{pH\ 1}$ 258 mμ (ε 9000), $\lambda_{min}^{pH\ 1}$ 234 (2700), $\lambda_{max}^{pH\ 4}$ 258 (6100), $\lambda_{min}^{pH\ 4}$ 237 (2700), $\lambda_{max}^{pH\ 11}$ 258 (6100), $\lambda_{min}^{pH\ 11}$ 235 (2500), $\lambda_{max}^{pH\ 14}$ 260 (6100), $\lambda_{min}^{pH\ 14}$ 238 (2700); pmr (D_2O) δ 2.03–3.11 (m, 2, 2′-H's), 3.63–3.82 ("s" centered at 3.66, "s" centered at 3.73, 2, 5′-C**H**$_2$OH), 4.35–4.65 (m, 2, 3′- and 4′-H's), 4.73 (solvent), 5.41 (s, 1, 5-H), 6.20 (q, 1, width 9.3, "*J*" = 2.3, "*J*" = 7.0 cps, 1′-H), 8.29 ppm (s, 1, 2-H).

Anal. Calcd for $C_9H_{13}N_3O_4$: C, 47.57; H, 5.77; N, 18.49. Found: C, 47.57; H, 5.73; N, 18.58.

The β anomer 9 was recrystallized from a mixture of methanol, ethanol and ethyl acetate to yield a product: mp 194–196°; $[\alpha]^{23}D$ +57.1° (*c* 1, water); $\lambda_{max}^{pH\ 1}$ 258 mμ (ε 8700), $\lambda_{min}^{pH\ 1}$ 235 (2500), $\lambda_{max}^{pH\ 4}$ 258 (6100), $\lambda_{min}^{pH\ 4}$ 237 (2500), $\lambda_{max}^{pH\ 11}$ 258 (6100), $\lambda_{min}^{pH\ 11}$ 235 (2700), $\lambda_{max}^{pH\ 14}$ 260 (6100), $\lambda_{min}^{pH\ 14}$ 238 (2500); pmr (D_2O) δ 2.29–2.64 (m, 2, 2-H's), 3.73–3.97 ("d", centered at 3.80, "*J*" = 2.0 cps, "s" at 3.88, 2, 5′-C**H**$_2$OH), 4.02–4.25 (m, 1, 4′-H), 4.35–4.72 (m, 3′-H overlapped by solvent at 4.60), 5.42 (s, 1, 5-H), 6.27 (t, 1, width 13.2 cps $J_{1',2'}$ = 6.6 cps, 1′-H), 8.34 ppm (s, 1, 2-H).

Anal. Calcd for $C_9H_{13}N_3O_4$: C, 47.57; H, 5.77; N, 18.49. Found: C, 47.30; H, 5.92; N, 18.57.

1-(β-D-Ribofuranosyl)-4-methylthio-6-pyrimidone (2).—To the trimethylsilyl derivative of 4-methylthio-6-pyrimidone (prepared from 12 g of 1[13]) was added 2,3,5-tri-*O*-acetyl-D-ribofuranosyl bromide (prepared from 20 g of tetra-*O*-acetyl-D-ribofuranose) in dry acetonitrile (170 ml). After initial stirring the solution was left at 5° for 1.5 days followed by a further 2.5 days at room temperature. The solution was then evaporated to a syrup. Sodium bicarbonate, water and ethanol were added and the mixture was evaporated to dryness. The remaining traces of water were removed by coevaporation with absolute ethanol. The residue was extracted with chloroform. The solvent was removed and the residue was extracted again with chloroform. The residue obtained after solvent removal was dissolved in benzene (250 ml) and applied to a column (5.0 × 46 cm) of alumina (Merck) prepacked in benzene. The material was washed on with benzene (2 l.) and 200-ml fractions were collected. The fractionation was monitored by tlc on alumina HF 254 with chloroform as developer. At fraction 11 the eluting solvent was changed to benzene–ethyl acetate (19:1). At fraction 21 the solvent was changed to benzene–ethyl acetate (9:1). Fractions 26–46 were evaporated to a syrup; the yield of crude 1-(2,3,5-tri-*O*-acetyl-β-D-ribofuranosyl)-4-methylthio-6-pyrimidone was 4.6 g. This material was dissolved in methanolic ammonia (60 ml, methanol saturated at 0°) and the sealed vessel was left overnight at room temperature. The solution was filtered and the filtrate was evaporated to dryness. Acetamide was removed by sublimation at 60° under oil pump vacuum. The residue was then triturated with a mixture of ethanol and 2-propanol to yield 2.47 g (15%) of **2**, mp 147–151°. Two crystallizations from methanol afforded pure white material: mp 154–155°; $[\alpha]_D$ +50.6° (*c* 1, water); λ_{max}^{KBr} 1645 cm^{-1} (C=O of pyrimidine), $\lambda_{max}^{pH\ 1}$ 270 mμ (ε 9860), 239 (19,200), $\lambda_{min}^{pH\ 1}$ 255 (8210), $\lambda_{max}^{pH\ 4}$ 269 (10,000), 238 (19,000) $\lambda_{min}^{pH\ 4}$ 253 (8200) $\lambda_{max}^{pH\ 11}$ 239 (34,800), sh 265 (13,700), $\lambda_{max}^{pH\ 14}$ 244 (10,500); pmr (D_2O) δ 2.40 (s, 3, 4-SCH$_3$), 3.84–4.10, 4.15–4.44 (m, 5, sugar ring H's), 5.96 (d, 1, $J_{1',2'}$ = 2.5 cps, 1′-H), 6.21 (s, 1, 5-H), 8.56 ppm (s, 1, 2-H).

Anal. Calcd for $C_{10}H_{14}N_2O_5S$: C, 43.75; H, 5.14; N, 10.22. Found: C, 43.64; H, 5.08; N, 10.12.

This compound was found to be homogeneous by tlc on SilicAR 7GF with ethyl acetate–methanol (9:1) as developer.

1-(β-D-Ribofuranosyl)-6-pyrimidone (3).—To 4-methylthio-1-(β-D-ribofuranosyl)-6-pyrimidone (**2**, 50 mg) in 2-methoxyethanol (20 ml) was added sponge nickel (500 mg previously washed with 2-methoxyethanol) and the mixture stirred under reflux for 3 hr. The mixture ws filtered through Celite and the filtrate was evaporated to dryness. The syrupy residue was applied to the short edge of a SilicAR 7GF plate (1 × 200 × 400 mm) and the plate was developed several times with ethyl acetate–methanol (9:1). The major component was excised and the adsorbent was extracted with absolute ethanol (300 ml). The extract was evaporated to a smaller volume whereupon crystallization occurred to yield 15 mg of white needles, mp 166–168°. The ir spectrum of this compound in KBr was superimposable upon that of the compound obtained by the method of Pfleiderer and Robins.[15] A mixture melting point showed no depression.

4-Methoxy-1-(β-D-ribofuranosyl)-6-pyrimidone (6).—1-(2,3,5-Tri-*O*-acetyl-β-D-ribofuranosyl)-4-methylsulfonyl-6-pyrimidone (**7**, 0.70 g of dry foam) was added to a solution of sodium (0.30 g) in anhydrous methanol (40 ml). The resulting solution was left at room temperature overnight and then neutralized to pH 7 with glacial acetic acid. The solution was evaporated to dryness and the residue dissolved in a mixture of acetic anhydride (30 ml) and pyridine (30 ml). The solution was stirred at room temperature for 1 day and finally poured onto ice and the aqueous mixture extracted with dichloromethane. The dichloromethane solution was washed consecutively three times with 1 *N* hydrochloric acid, once with water and saturated sodium bicarbonate solution, and three times with water. The dried ($MgSO_4$) solution was evaporated to a syrup. This material was applied to the short edge of three SilicAR 7GF gel plates (2 × 200 × 400 mm) and the plates were developed several times using benzene ethyl acetate (2:1). The main band was excised and the adsorbent was extracted with methanol. The methanol was removed by evaporation and the residue extracted with dichloromethane. The dichloromethane was removed to give a dry syrup. This syrup was dissolved in anhydrous methanol (30 ml) and a small piece of sodium (50 mg) was added. After 2 hr at room temperature the stirred solution was neutralized to pH 7 by portionwise addition of Dowex 50 H^+ (X4, 200–400) resin. The resin was removed by filtration and washed well with methanol. The filtrate and washings were evaporated to dryness and the residual syrup was crystallized from ethanol–ethyl acetate to yield 0.20 g (48%), mp 77–80°; it resolidified and melted again at 118–120°. This material was dissolved in hot ethanol and the solution was decolorized with charcoal. After solvent removal **6** was crystallized from ethanol–ethyl acetate to give pure material: mp 129–130°; $[\alpha]^{25}D$ +49.4° (*c* 1, water); λ_{max}^{KBr} 1650 cm^{-1} (C=O of pyrimidine); $\lambda_{max}^{pH\ 1,4,11}$ 262 mμ (ε 6700), $\lambda_{min}^{pH\ 1,4,11}$ 243 (2200), $\lambda_{max}^{pH\ 14}$ 253 mμ (5900); pmr (D_2O) δ 3.82–4.03 (s at 3.90, 4-OC**H**$_3$ and s at 3.95, 5′-C**H**$_2$OH, 5), 4.12–4.46 (m, 3, 2′-, 3′-, and 4′-H's), 4.70 (solvent), 5.79 (s, 1, 5-H), 5.96 (d, 1, $J_{1',2'}$ = 2.0 cps, 1′-H), 8.54 ppm (s, 1, 2-H).

Anal. Calcd for $C_{10}H_{14}N_2O_6$: C, 46.51; H, 5.47; N, 10.85. Found: C, 46.20; H, 5.12; N, 10.55.

Prystas[4] reported mp 77–81° for **6**. This melting point would appear to be the melting point of an ethanol solvate and was obtained prior to the preparation of the analytical sample. Upon thorough drying **6** exhibits one melting point, *viz.* 129–130°

Registry No.—**2**, 18645-79-9; **6**, 13566-76-2; **8**, 18645-81-3; **9**, 18645-82-4; **9a**, 18645-83-5; **10**, 18645-84-6.