3b.—A solution of 0.5 g. (2 mmoles) of benzyl 2-*n*-butoxycyclopropanecarbamate in 20 ml. of ethyl acetate, containing 125 mg. of 10% Pd on C, was hydrogenated at 25° at atmospheric pressure. After completing the hydrogen absorption the amine was worked up and converted to the cyclohexylsulfamate salt, m.p. 134–138° (from ethyl acetate–tetrahydrofuran).

Anal. Calcd. for $C_{13}H_{28}N_2O_4S$: C, 50.63; H, 9.15. Found: C, 50.63; H, 9.34.

The infrared spectra of the salts prepared by methods 3a and 3b were identical.

***trans*(?)-N-(2-*n*-Butoxycyclopropyl)-N,N,N-trimethylammonium Iodide.**—The oily 2-*n*-butoxycyclopropylamine (6.1 g., 0.047 mole) was quaternized with methyl iodide as described for the 2-benzyloxy analog above. The reaction mixture was filtered, the filtrate was evaporated, the residue (16.8 g.) was extracted with 120 ml. of chloroform, and the extract was cleared with charcoal. Evaporation of the chloroform and washing of the residue with ethyl acetate left 13.4 g. of a solid which crystallized from ethanol–ether and chloroform–ether, yielding 10.8 g. (76%), m.p. 108–110°; infrared absorptions at 1020 and 838 cm.$^{-1}$.

Anal. Calcd. for $C_{10}H_{22}INO$: C, 40.14; H, 7.41; N, 4.68. Found: C, 40.06; H, 7.35; N, 4.58.

In the n.m.r. spectrum, the one-proton peak at τ 5.8 was considered characteristic of the hydrogen at position 2 (*cf.* Table I, *trans* isomer).

No isomer of this quaternary salt was obtained. While it is possible that stereoisomeric intermediates may have been lost during the synthesis, the appearance of one major carbonyl peak in the infrared spectrum (1725 cm.$^{-1}$) of ethyl 2-*n*-butoxycyclopropanecarboxylate, with only a small shoulder at 1735 cm.$^{-1}$, implies that one isomer, probably the *trans* form, predominated already in this ester. A similar observation has been substantiated in the case of the isomeric ethyl 2-ethoxycyclopropanecarboxylates[12]; in analogous cases the lower frequency has been assigned to the *trans* isomer.[13,14]

Pharmacology.—Compounds I, II, and III were tested in the following systems: (a) isolated guinea pig ileum *in vitro*, at concentrations of 10^{-2} to 10^{-3} mg./ml.; (b) blood pressure effects in cats (for III also in rats). Vagotomized animals were used under chloralose or pentobarbital anesthesia. Pressor effects were also measured after pretreatment with reserpine (2 doses of 0.3 mg./kg. on the two days preceding the experiment), neostigmine (0.1 mg./kg.), and phentolamine and hexamethonium (1 mg./kg.). (c) Ganglionic effects in the cat under urethane or chloralose anesthesia; effects on the blood pressure and urinary bladder tension were measured by the method of Chen, *et al.*[7] The effect of preganglionic sympathetic stimulation was determined by the contraction of the nictitating membrane of the cat. (d) Effects on neuromuscular transmission were measured by stimulating the sciatic nerve and registering the contraction of the gastrocnemii in rats. (e) The LD_{50} was determined in mice by intravenous injection.

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Derivatives of 1-(5-Nitrofurfurylideneamino)hydantoin. Synthesis and Some Biological Properties

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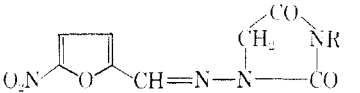
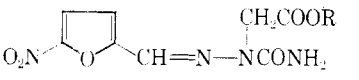
1-(5-Nitrofurfurylideneamino)hydantoin[1] has been widely used in the therapy of urinary tract infections. High urinary concentrations follow oral administration of this drug, but blood levels are unimportant even after intravenous administration of its sodium salt.[2] Attempts to modify its structure have not given satisfactory biological results.[3–5] The effects of 3-substituents in the hydantoin ring on the antibacterial activity, toxicity, and protein-binding capacity of the drug have now been investigated.

We have examined compounds with the following general formula



I, R = CH_2COOH V, R = $CH_2CH_2N(C_2H_5)_2$
II, R = $CH_2COOC_2H_5$ VII, R = *m*-ClC_6H_4
IV, R = C_6H_5

and the two semicarbazidoacetic acid derivatives III and VI.



III, R = C_2H_5
VI, R = H

Compound I was prepared according to Jack.[4] Compounds II, III, and VI already have been described,[4,6,7] but we have prepared II by a modified procedure; II and V were obtained by reaction of the sodium salt of 1-(5-nitrofurfurylideneamino)-hydantoin with ethyl chloroacetate and β-diethylaminoethyl chloride, respectively. Compounds IV and VII were obtained from the corresponding 1-aminohydantoins, prepared from 4-substituted semicarbazides by reaction with ethyl chloroacetate and sodium ethoxyde,[8] while III and VI were obtained simply from 5-nitro-2-furaldehyde and semicarbazidoacetic acid or its ethyl ester.

Materials and Methods. Antibacterial Spectrum.—Sensitivity determinations were carried out by the broth dilution method using phenol red mannitol broth (Difco) for the genera *Salmonella, Staphylococcus, Escherichia,* and *Aerobacter;* phenol red dextrose broth (Difco) for the genera *Bacillus, Shigella, Streptococcus,* and *Proteus;* and nutrient broth (Difco) for *Klebsiella pneumoniae, Alkaligenes faecalis,* and *Sarcina lutea.* Nitrofuran solutions were prepared by dissolving the compound in a 1:1 (v./v.) dimethylformamide–physiological saline mixture and Seitz filtering the solution. The inocula were prepared by making a 1:100 dilution of 18-hr. cultures grown in brain–heart infusion broth (Difco).

Acute Toxicity.—Swiss white mice (19–20 g.) were injected intraperitoneally with 1 ml. of solution. Deaths were noted over 7 days and the LD_{50} values were calculated by the method of Litchfield and Wilcoxon.[9]

Plasma Binding.—The ultrafiltration method[10] was used. About 10–15 ml. of plasma was pipetted into a dialyzer tubing (diameter inflated to 3 cm.) that was soaked in physiological saline and dried at room temperature. The cellophane sack was placed in a heavy-walled glass tube (9 × 2.9 cm.) about 2 cm. from the bottom. The tube was then centrifuged for about 3 hr. at 3000 r.p.m. Of the ultrafiltrate, 0.6 ml. was used for the

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TABLE I

Compound	Plasma binding, %	Acute toxicity LD_{50} in Swiss white mice, mg./kg.
I	13	1600
II	43.5	108
III	6	850
IV	74.5	840
V	23.5	258
VI	18.5	820
VII	100	1580
1-(5-Nitrofurfurylidene-amino)hydantoin (VIII)	18	

analytical assay according to Buzzard.[11] The amount of nitrofuran bound to plasma proteins was calculated by the difference between the original concentration in the plasma and the concentration in the ultrafiltrate.

Discussion

Effect on Binding to Plasma Proteins.—Because of the variety of methods generally employed for plasma binding study of nitrofurans,[12] we chose 1-(5-nitrofurfurylideneamino)hydantoin as a standard (Table I). From these data it is evident that, whatever the 3-substituent, there is generally an increased binding to proteins with respect to 1-(5-nitrofurfurylideneamino)hydantoin, particularly in IV and VII, where the substituent is an aryl group. Moreover there seems to be no relation between esterification and protein binding; in fact II is more firmly bound than I, while III is less strongly bound than VI.

Influence on the Antibacterial Activity.—The minimum inhibitory concentration (M.I.C.) of the test compounds was studied with a number of microorganisms (Table II). There was no activity in the carboxylic acids (I and VI) whereas their esters (II and III) show good antibacterial activity. Other workers observed similar results with 5-nitrofuroic acid and its ester[13] and also with I and II,[4] but these observations were restricted to a very limited number of organisms. Our experiments, carried out on a variety of microorganisms, confirm the hypothesis that carboxylic acid derivatives of nitrofuran are inactive.

Compound V, which contains a basic group, shows no antibacterial activity, while we know that 5-morpholinomethyl-3-(5-nitrofurfurylideneamino)oxazolidone[14] and other basic nitrofurans[5] are very active. This confirms the importance of the nature of the 2-substituent for nitrofurans independently from the chain proposed by Dodd.[13] Antibacterial activity is not really altered by the 3-substitution with aryl groups (IV and VII); in fact, the action against *Escherichia coli* is maintained, whereas the 5-phenyl analog is described as practically inactive.[4]

Effect on Toxicity.—Introduction of a diethylaminoethyl group into position 3 increased the toxicity substantially; 3-aryl substitution did not cause effective variations, whereas 5-aryl substitution has been described to produce a particularly high toxicity.[4] A low degree of toxicity is shown by the 3-chlorophenyl substituted derivative (Table I).

Experimental

Melting points were taken on a Kofler apparatus and are corrected.

Ethyl 1-(5-Nitrofurfurylideneamino)-3-hydantoinacetate (II).—A suspension of 2.6 g. (0.01 mole) of the sodium 1-(5-nitrofurfurylideneamino)hydantoin[15] in 20 ml. of methanol containing 2.44g. (0.02 mole) of anhydrous ethyl chloroacetate was heated at 50° for 3 hr. The reaction mixture then was filtered, and the solvent was removed *in vacuo*. The residue, crystallized from methanol (decolorizing charcoal), melted at 155.5–156.5°. The melting point was not depressed on admixture with an authentic sample.[4]

Ethyl 1-(5-nitrofurfurylidene)-2-semicarbazidoacetate (III) was obtained by treating an aqueous solution of ethyl 2-semicarbazidoacetate[16] with 5-nitro-2-furaldehyde in ethanol. After recrystallization from methanol, the melting point was 180.5–181.5° (lit.[6] m.p. 178°).

1-(5-Nitrofurfurylidene)-2-semicarbazidoacetic Acid (VI).—5-Nitro-2-furaldehyde (3.1 g.) in 5 ml. of methanol was added to 40 ml. of a hot aqueous solution containing 3 g. of 2-semicarbazidoacetic acid[17]; the product quickly separated and after recrystallization from water–dimethylformamide melted at 231.5–236.5° dec. (lit.[7] m.p. 234–235°).

1-(5-Nitrofurfurylideneamino)-3-(β-diethylaminoethyl)hydantoin (V).—Sodium 1-(5-nitrofurfurylideneamino)hydantoin[15] (3.12 g., 0.012 mole) was added to 15 ml. of methanol containing 1.35 g. of β-diethylaminoethyl chloride; the mixture was heated at 40° for 1 hr. and then filtered at the same temperature. On cooling, the product separated as yellow crystals. An analytical sample, crystallized from methanol, melted at 113–114°.

Anal. Calcd. for $C_{14}H_{19}N_5O_5$: C, 49.84; H, 5.68; N, 20.76. Found: C, 49.57; H, 5.97; N, 20.72.

The hydrochloride melted at 229.5–233.5° and the picrate at 90–93°. After this work was completed, the hydrochloride of this compound was reported by another group.[18] These authors described a different method of preparation, m.p. 227–230°. No data are reported for the corresponding base.

1-Benzylideneamino-3-phenylhydantoin.—Benzaldehyde 4-phenylsemicarbazone[19] (23.9 g., 0.1 mole) was added to a solution of sodium (2.3 g.) in anhydrous ethanol (75 ml.), and the mixture was refluxed with stirring for 10 min. Then at 70° ethyl chloroacetate (12.2 g.) was added and the reaction mixture refluxed for 1 hr. The cooled mixture was diluted with water (150 ml.) and filtration gave the crude product (15 g. air-dried), m.p. 190–200°. Recrystallization from ethanol raised the melting point to 206.5–207.5°.

Anal. Calcd. for $C_{16}H_{13}N_3O_2$: C, 68.80; H, 4.69; N, 15.05. Found: C, 68.68; H, 4.90; N, 15.10.

1-(5-Nitrofurfurylideneamino)-3-phenylhydantoin (IV).—A suspension of 13.95 g. of 1-benzylideneamino-3-phenylhydantoin in HCl (125 ml.) and water (125 ml.) was heated until all the benzaldehyde had distilled. After cooling at 70–75°, 5-nitro-2-furaldehyde (6.76 g., 0.048 mole) was added. A yellow product quickly separated, which was collected by filtration, washed with water, and recrystallized from ethyl acetate–ligroin, m.p. 230.5–232.5° dec.

Anal. Calcd. for $C_{14}H_{10}N_4O_5$: C, 53.51; H, 3.21; N, 17.83. Found: C, 53.67; H, 3.27; N, 17.80.

Benzaldehyde 4-(3-Chlorophenyl)semicarbazone.—With good stirring, 65 g. of acetone semicarbazone was added to 325 ml. of 3-chloroaniline at 200°. The solution was allowed to stand at 200° for 15 min. and, after cooling, was poured into 2000 ml. of 10% acetic acid. A brown oil separated, which crystallized on standing; the solid was filtered and hydrolyzed by refluxing for 20 min. with 500 ml. of dilute HCl. The hot mixture was filtered from the solid residue, and the solution was treated

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TABLE II: MINIMUM INHIBITORY CONCENTRATION OF THE VARIOUS NITROFURANS (γ/ml.)

Microorganism	Compound I	II	III	IV	V	VI	VII	VIII[b]
Salmonella typhi Manzari	>100	50	50	50	>100	>100	12.5	12.5
S. paratyphi A-7	>100	50	25	25	>100	100	25	50
S. parathyphi A-15	>100	12.5	12.5	100	>100	>100	25	25
S. paratyphi B-8	>100	25	12.5	25	>100	>100	50	25
S. paratyphi B-19	>100	50	25	25	>100	>100	50	25
S. typhimurium	>100	50	25	6.25	>100	>100	25	50
S. gallinarum	>100	50	25	>100	>100	>100	25	25
S. San Diego	>100	50	50	25	>100	>100	25	12.5
S. enteritidis	>100	100	100	25	>100	>100	12.5	25
S. enteritidis-33	>100	50	50	25	>100	>100	50	25
S. paratyphi C	>100	12.5	12.5	6.25	>100	>100	25	50
S. virginia	>100	50	25	25	>100	>100	25	12.5
S. schleisseim	>100	50	25	25	>100	>100	25	12.5
S. thompson	>100	50	25	25	>100	>100	25	25
S. lomita	>100	50	25	100	>100	>100	25	12.5
Shigella dysenteriae 2	>100	25	12.5	12.5	>100	>100	25	12.5
Shigella flexneri	>100	12.5	12.5	12.5	>100	>100	25	50
Shigella alkalescens	>100	25	25	12.5	>100	>100	25	12.5
Escherichia coli A B 2/4	>100	100	25	50	>100	>100	25	25
E. coli R I 102/50	>100	100	25	25	>100	>100	25	12.5
Proteus vulgaris	>100	100	100	12.5	>100	>100	25	12.5
Aerobacter aerogenes	>100	>100	>100	25	>100	>100	25	25
Klebsiella pneumoniae	>100	25	25	25	>100	>100	25	25
Alcaligenes faecalis	>100	>100	100	25	>100	>100	25	25
Bacillus cereus (var. asporigeno)	>100	12.5	25	12.5	>100	>100	25	12.5
B. cereus (var. sporigeno) (CISS)	>100	12.5	12.5	6.25	>100	>100	25	12.5
B. cereus (var. sporigeno)	>100	12.5	12.5	12.5	>100	>100	25	12.5
B. megatherium	>100	12.5	6.25	50	>100	>100	25	25
B. coagulans	100	100		6.25	>100	>100	6.25	50
B. laterosporus	100	0.41	0.19	1.56	>100	>100	1.56	3.12
B. circulans	100	6.25	12.5	25	>100	>100	25	25
B. sphaericus	>100	6.25	6.25	6.25	>100	>100	6.25	12.5
B. subtilis 6633	>100	3.12	3.12	25	>100	>100	50	25
Clostridium perfrigens C	100	6.25			>100	>100		
Sarcina lutea	>100	100	>100	6.25	>100	>100	12.5	25
Micrococcus epidermidis	100	6.25	25	25	>100	>100	12.5	12.5
M. lysodeikticus	>100	50	25	25	>100	>100	25	50
M. flavus	100	12.5	1.56	50	>100	>100	25	12.5
M. pyogenes (var. aureus)	100	12.5	25	12.5	>100	>100	25	6.25
M. pyogenes (var. aureus) Smith 13709	100	12.5	12.5	6.25	>100	100	12.5	12.5
M. pyogenes (var. aureus) 112	>100	25	50	6.25	>100	>100	25	25
M. pyogenes (var. aureus) 10537	>100	12.5	25	25	>100	>100		25
M. pyrogenes (var. aureus) 7	>100	50	25	12.5	>100	>100	12.5	
M. pyogenes (var. aureus) 119	>100	25	25	12.5	>100	>100	25	50
M. pyogenes (var. aureus) 24	100	25	25	25	>100	>100	12.5	25
M. pyogenes (var. aureus) 6538 P	>100	12.5	25	0.78	>100	>100	25	12.5
M. pyogenes (var. aureus)	>100	6.25	12.5	6.25	>100	>100	12.5	12.5
M. pyogenes (var. aureus) 240[a]	>100	12.5	25	12.5	>100	>100	25	25
M. pyogenes (var. aureus) 236[a]	>100	25	25	25	>100	>100	25	25
M. pyogenes (var. aureus) 288	>100	12.5	25	12.5	>100	>100	25	12.5
M. pyogenes (var. aureus) 249[a]	>100	12.5	25	12.5	>100	>100	25	12.5
M. pyogenes (var. aureus) 257[a]	>100	12.5	25	25	>100	>100	25	25
M. pyogenes (var. aureus) 264[a]	>100	25	25	50	>100	>100	25	25
M. pyogenes (var. aureus) 222[a]	>100	12.5	25	12.5	>100	>100	25	25
M. pyogenes (var. aureus) 195[a]	>100	12.5	25	25	>100	>100	25	12.5
M. pyogenes (var. aureus) 187[a]	100	12.5	25	12.5	>100	>100	25	25
M. pyogenes (var. aureus) 164[a]	>100	12.5	25	12.5	>100	>100	25	12.5
M. pyogenes (var. aureus) 219[a]	100	12.5	25	12.5	>100	>100	25	12.5
M. pyogenes (var. aureus) 184	100	12.5	25	12.5	>100	>100	25	25
M. pyogenes (var. aureus) 230	100	12.5	25	25	>100	>100	25	12.5
M. pyogenes (var. aureus) 192	>100	12.5	25	12.5	>100	>100	25	50
M. pyogenes (var. aureus) 225	>100	12.5	50	25	>100	>100	25	12.5
M. pyogenes (var. aureus) 227	>100	12.5	25	25	>100	>100	25	12.5
M. pyogenes (var. aureus) 203	100	12.5	25	12.5	>100	>100	25	25
Streptococcus pyogenes—A	>100	12.5	12.5	6.25	>100	>100	12.5	25
S. faecalis	>100	>100	100	50	>100	>100	25	25
Monilia W	100	100	100	25	100	100		50
Torula 9226	100	100	100	12.5	100	100		12.5

[a] Penicillin-resistant strains isolated in hospital. [b] VIII: 1-(5-nitrofurfurylideneamino)hydantoin.

with benzaldehyde (15 ml.) and ethanol (85 ml.). After 2 hr. the product was collected by filtration and recrystallized from ethanol; an analytical sample melted at 187.5–189.5°.

Anal. Calcd. for $C_{14}H_{12}ClN_3O$: C, 61.43; H, 4.42; Cl, 12.95; N, 15.35. Found: C, 61.14; H, 4.66; Cl, 12.93; N, 15.04.

1-Benzylideneamino-3-(3-chlorophenyl)hydantoin.—Benzaldehyde 4-(3-chlorophenyl)semicarbazone (5.46 g., 0.02 mole) and 2.44 g. (0.02 mole) of ethyl chloroacetate were added at 55–60° to an ethanolic sodium ethoxide solution (prepared from sodium (0.46 g.) and ethanol (15 ml.)), and the mixture was refluxed for 1 hr. After cooling, it was diluted with water (200 ml.) to separate the crude product which, air-dried, melted at 135–145°. An analytical sample (from ethyl acetate–ligroin) melted at 190.5–192.5°.

Anal. Calcd. for $C_{16}H_{12}ClN_3O_2$: C, 61.25; H, 3.86; Cl, 11.30; N, 13.39. Found: C, 61.01; H, 3.89; Cl, 11.15; N, 13.27.

1-(5-Nitrofurfurylideneamino)-3-(3-chlorophenyl)hydantoin (VII).—1-Benzylideneamino-3-(3-chlorophenyl)hydantoin (15.65 g.) in 200 ml. of diluted HCl was heated until all the benzaldehyde distilled; 5-nitro-2-furaldehyde (6 g.) was added and the solution was stirred at 70° for 15 min. and then cooled and filtered. The yellow crystals (from ethyl acetate–ligroin) melted at 156–161° dec.

Anal. Calcd. for $C_{14}H_9ClN_4O_5$: C, 48.21; H, 2.60; Cl, 10.16; N, 16.06. Found: C, 48.02; H, 2.55; Cl, 10.05; N, 15.95.

1-(5-Nitrofurfurylidene)-4-(3-chlorophenyl)semicarbazide.—This compound was prepared by the same procedure as described for benzaldehyde 4-(3-chlorophenyl)semicarbazone using 5-nitro-2-furaldehyde instead of benzaldehyde. After crystallization from ethanol–dimethylformamide the product melted at 226.5–232.5° dec.

Anal. Calcd. for $C_{12}H_9ClN_4O_4$: C, 46.68; H, 2.93; Cl, 11.81; N, 10.15. Found: C, 46.57; H, 2.89; Cl, 11.76; N, 10.02.

1-Amino-3-phenylhydantoin.—1-Benzylideneamino-3-phenylhydantoin (13.95 g.) was hydrolyzed by heating in HCl (125 ml.) and water (125 ml.) and distilling all the benzaldehyde. The hot solution was filtered and concentrated *in vacuo* to a small volume; on cooling at 0° for several hours the crude hydrochloride separated. It was dissolved in a little water and the solution made alkaline with ammonium hydroxide to the free base, which after recrystallization from water melted at 119–122°.

Anal. Calcd. for $C_9H_9N_3O_2$: C, 56.54; H, 4.75; N, 21.98. Found: C, 56.48; H, 4.71; N, 21.93.

1-Amino-3-(3-chlorophenyl)hydantoin.—This compound was prepared essentially by the same procedure as the one described above for 1-amino-3-phenylhydantoin, starting from 1-benzylideneamino-3-(3-chlorophenyl)hydantoin. After crystallization from water, the melting point was 108–109°.

Anal. Calcd. for $C_9H_8ClN_3O_2$: C, 47.90; H, 3.58; Cl, 15.71; N, 18.62. Found: C, 47.78; H, 3.52; Cl, 15.63; N, 18.48.

The Anomeric 5-Allyl-2′-deoxyuridines[1]

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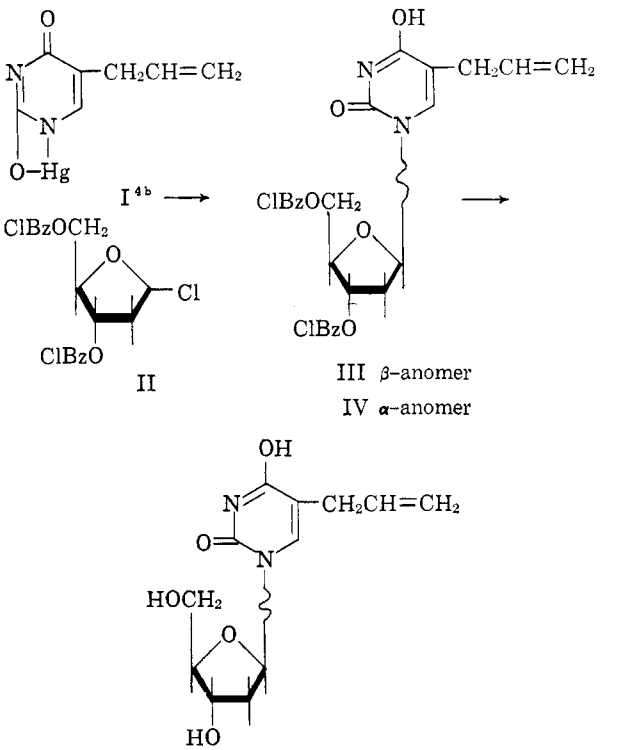
Interest in the chemotherapeutic properties of analogs of the naturally occurring pyrimidines and pyrimidine nucleosides of RNA and DNA in which changes have been made at the 5-position of the pyrimidine ring led us to prepare a number of 5-allylpyrimidines,[2] including 5-allyluridine.[3] We now wish to report the preparation of the anomeric 5-allyl-2′-deoxyuridines. While 5-allyluridine was reported as devoid of biological activity in several test systems,[3] the corresponding deoxyribosides reported here diminish catabolism of thymidine and 5-fluoro-2′-deoxyuridine in HeLa–PPLO (pleuropneumonia-like organisms) cultures.

In accordance with the structure of the mercury salt[4] one molar portion of 5-allyluracilmercury (I) was condensed with two molar portions of 3,5-(di-O-*p*-chlorobenzoyl)-2-D-deoxyribosyl chloride (II) in refluxing toluene to give a mixture of the blocked β- and α-nucleosides (III and IV) in 80% apparent yield as a tan glass. Condensations with a halogenose blocked with *p*-tolyl groups gave similar results. Alumina column chromatography showed that the crude material consisted of 21% of the mixed anomers (thus, 16% actual yield from I), the remainder being unidentified material.

CHART I



The anomers could not be separated by alumina column chromatography, although the mixed anomers

(1) This investigation was supported by Grant CA-02857 from the National Cancer Institute, National Institutes of Health, U. S. Public Health Service.

(2) H. J. Minnemeyer, J. A. Egger, J. F. Holland, and H. Tieckelmann, *J. Org. Chem.*, **26**, 4425 (1961).

(3) H. J. Minnemeyer, H. Tieckelmann, and J. F. Holland, *J. Med. Chem.*, **6**, 602 (1963).

(4) (a) It has been reported that, in the synthesis of pyrimidine deoxyribosides, a "more reactive" mercury salt is required,[5] that is, one in which the pyrimidine and mercury are present in a 1:1 molar ratio. By chance, of three possible mercury salts,[6] this is the salt formed by the reaction of 5-allyluracil with mercuric chloride and sodium hydroxide. In contrast to thymine[7] it was not necessary to attempt the preparation of such a salt by other methods. (b) Structural formula I is intended only as a convenient representation which reflects the empirical formula of this compound.

(5) M. Hoffer, R. Duschinsky, J. J. Fox, and N. Yung, *J. Am. Chem. Soc.*, **81**, 4112 (1959).

(6) J. J. Fox, N. Yung, I. Wempen, and I. L. Doerr, *ibid.*, **79**, 5060 (1957).

(7) M. Hoffer, *Chem. Ber.*, **93**, 2777 (1960).