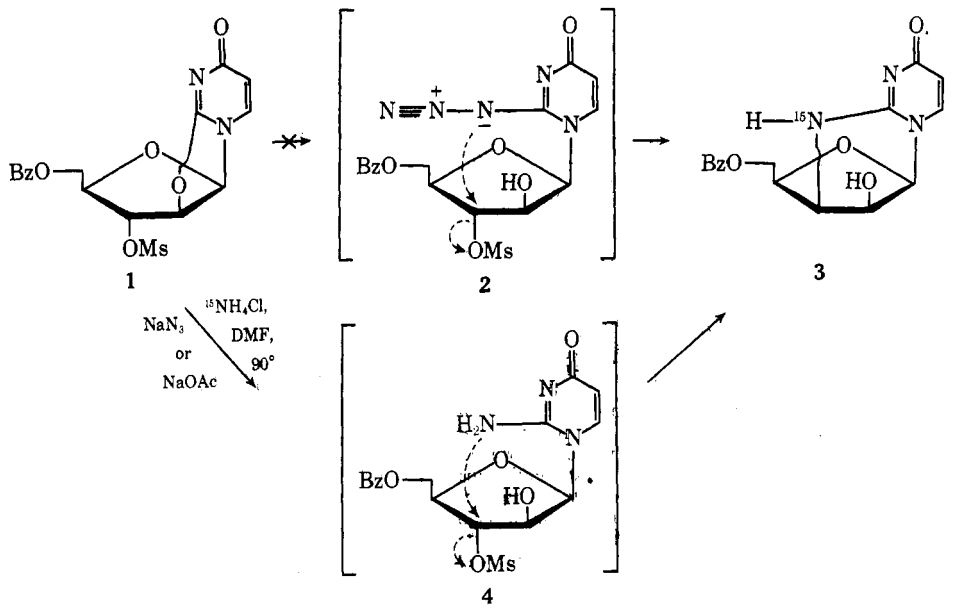

$$\overset{+}{N}H_4\overset{-}{Cl} + \overset{+}{Na}\overset{-}{N_3} \rightleftharpoons NH_3 + HN_3 + \overset{+}{Na}\overset{-}{Cl} \quad (1)$$

(NH_4Cl) = 9.25, pK_a (HN_3) = 4.72][5] steady-state concentration of ammonia, and Fox's results[4] would suggest that reaction of ammonia with cyclonucleoside 1 might be very rapid in DMF at 90 °C.

Treatment of 1[6] with 99 atom % ^{15}N-ammonium chloride[7] and ^{14}N-sodium azide in DMF at 90 °C for 12 h and processing as described[2] gave 71% (65% recrystallized) **3**: mp 258–260 °C (after the first crystallization), mp 285–286 °C (after recrystallization); uv (0.1 N HCl) max 232 nm (ε 17 000), sh 264 (6700), min 216 (12 000); uv (MeOH) max 217 nm (ε 32 600), sh 227, 262 (29 700, 4400) [lit.[2] mp 250–252 °C; uv (MeOH) max 217 nm (ε 33 300), sh 261 (4000); yield 70%]. The mass spectrum of this product had *m/e* 330.0974, calcd for M^+ ($C_{16}H_{15}{}^{14}N_2{}^{15}NO_5$) 330.0982. Comparison of mass spectra (AEI MS-50 with computer averaging of nine scans under identical conditions) of this product and a sample prepared using $^{14}NH_4Cl$ indicated complete incorporation of ^{15}N. Therefore, displacement of O^2 at the pyrimidine terminus of 1 by ammonia to give intermediate 4 followed by intramolecular cyclization to 3 is compatible with the labeling experiment. If this interpretation is correct, reaction of 1 with ammonium chloride and the salt of an acid of comparable strength with that of hydrazoic acid would be expected to proceed analogously. Acetic acid (pK_a = 4.76)[5] and hydrazoic acid (pK_a ~ 4.72)[5] are almost identical in acid strength. Treatment of 1 with an eightfold molar excess of ammonium chloride and sodium acetate in DMF at 90 °C under identical conditions with those above resulted in formation of 3 in 82% (72% recrystallized) yield. Thus, there is no evidence for formation of 2 or the implausible mechanism noted.[2]

Doerr and Fox[8] have observed that 2-amino-1-(β-D-arabinofuranosyl)-4-pyrimidinone (1-β-D-arabinofuranosylisocytosine) is very easily (even during warming for recrystallization) converted to the $O^2 \rightarrow 2'$-anhydro uracil product by attack of the "up" $O^{2'}$ at C^2 with evolution of ammonia. Therefore, ammonia displacement of oxygen at the pyrimidine terminus of the 3′-hydroxy-$O^2 \rightarrow 2'$-anhydro compound[2] (analogous to intermediate 4) would be unproductive since reversal to the $O^2 \rightarrow 2'$ cyclonucleoside would be expected to proceed readily in DMF at 110 °C.[8] In contrast, attack by azide at $C^{2'}$ would lead to the observed[2] 2′-azido-2′-deoxy uracil nucleoside, presumably irreversibly. Thus, azide attack at $C^{2'}$ of cyclonucleosides is the normal course[3] and does not result from absence of a "through bond" electronegative effect[2] in the case of the 3′-hydroxy compound. All chemistry involved in these reactions is in harmony with precedents[3,4,8] in the literature.

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(9) Postdoctoral Fellow (on leave from Kohjin Co., Ltd.), 1975–present.

Morris J. Robins,* Tadashi Kanai[9]
Department of Chemistry, The University of Alberta
Edmonton, Alberta, Canada T6G 2G2
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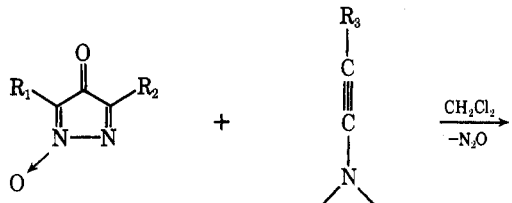
Synthesis of 3-Dialkylaminocyclopentadienones[1]

Summary: The title compounds are prepared by condensation of 3,4-diazacyclopentadienone 3-oxides with ynamines. The regiospecificity of the reaction was proven by hydrolysis of the amines to cyclopentene-3,5-diones.

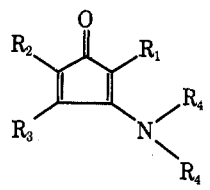
Sir: The cycloaddition chemistry of 3,4-diazacyclopentadienone oxides[2] and related compounds[3,4] with acetylenes has previously been reported and involved deep-seated rearrangements which could be rationalized from a first-formed 1,3-dipolar cycloadduct. In contrast with these results we have now found that ynamines (2) condense with 3,4-diazacyclopentadienone 3-oxides (1) in a Diels–Alder sense to produce 3-dialkylaminocyclopentadienones (3) in good yields (60–70%). These are the first representatives of this group of compounds to be reported.

In a typical preparation addition of 1.1 equiv of ynamine 2 to a stirred solution of 1 (1 equiv) in CH_2Cl_2 led to an exo-



1a, $R_1 = R_2 = C_6H_5$
b, $R_1 = CH_3$; $R_2 = C_6H_5$

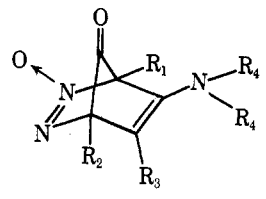
2a, $R_3 = CH_3$; $R_4 = C_2H_5$
b, $R_3 = C_6H_5$; $R_4 = CH_3$



3a, $R_1 = R_2 = C_6H_5$; $R_3 = CH_3$; $R_4 = C_2H_5$ (mp 96-97 °C)
b, $R_1 = R_2 = R_3 = C_6H_5$; $R_4 = CH_3$ (mp 152-153 °C)
c, $R_1 = R_4 = CH_3$; $R_2 = R_3 = C_6H_6$ (mp 140-142 °C)

thermic reaction and gas (N_2O) was immediately evolved. Evaporation of the solvent and chromatography of the resulting residue on a neutral alumina column with $CHCl_3$ as the eluent yielded the cyclopentadienones **3** as purple[5] bands which were further purified by recrystallization from hexane.

This reaction appears to be a Diels–Alder reaction analogous to that of ordinary cyclopentadienones,[6] followed by the loss of nitrous oxide rather than carbon monoxide. However, the formation of the cycloadduct may not be concerted but rather a two-step process involving a nucleophilic attack of the ynamine on the heterocycle **1**, followed by collapse to the Diels–Alder adduct. Two possible regioisomers (**4** and **5**) could result. However, the condensation of the unsymmetrical 3,4-diazacyclopentadienone (**1b**) with ynamine **2b** yielded



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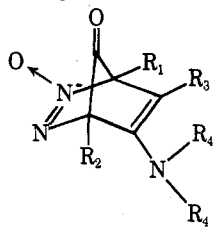
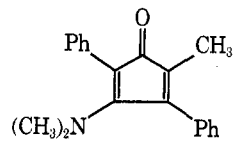


5

cyclopentadienone **3c** with no detectable amount of **6** (^1H NMR analysis) and thus established **4** as the intermediate. The structure of **3c** was established by hydrolysis in refluxing 5% $HClO_4$ to yield **7c**,[7] whose ^1H NMR spectrum unambiguously confirmed the structural assignment [δ_{CH_3} 1.37 (d, J = 7.5 Hz)].



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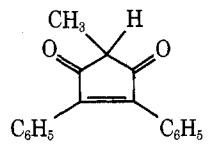

7c

This cycloaddition reaction is remarkably different from the earlier cycloadditions in this series,[2a] which presumably involve 1,3 cycloadditions across the nitrone group. The possibility of a common intermediate which partitions between a 1,3 cycloadduct and a 1,4 cycloadduct might explain this periselectivity. However, the regioisomer characterized from the cycloaddition of simple nitrones with ynamines[8] suggests that the partitioning intermediate would yield a 1,4 cycloadduct of structure **5**. Therefore, it is a reasonable assumption that the reaction involves a nucleophilic attack of the ynamine on the imine carbon[9] which then collapses to yield **4**.

Supplementary Material Available. Spectral data for compounds **3** and **7** (2 pp). Ordering information is given on any current masthead page.

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Jeremiah P. Freeman,* Raymond C. Grabiak
Department of Chemistry, University of Notre Dame
Notre Dame, Indiana 46556

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