particularly the chemical shifts for H-2, led to the belief that the proposed skeleton of benzoylated methyl pillaroside was neither **3** nor **4.** This doubt was intensified by the observation that **3b** and **4b** were destroyed when treated with 50% H_2O-HOAC followed by MeOH-HCl under conditions used to obtain methyl pillaroside from pillaromycin A.[2]

In the light of the crystallographic study,[1] the epimers **5** and **6** were synthesized from the ketone **11**[12] (Scheme II). The strategy adopted was based on the premise that reagents would approach the trigonal center in **11** from the direction *a* rather than *b*. Thus the desired stereochemistries in **5** and **6** would be generated by oxidation or alkylation of suitable receptors.

With this approach in mind, the acrylate ester **11b** obtained from Wadsworth-Emmons-Wittig[15a] reaction of **11a**[15b] was reduced with $LiAlH_4$, tritylated, and hydroxylated to give the diol **12**[16] in 27% yield from **11.** Oxidation of **12** with the Moffatt reagent[17,18] followed directly by detritylation,[8] gave **5a** in 27% yield after chromatography. Upon benzoylation, **5b** was obtained as an oil (91%).

For preparation of the epimer **6** (Scheme II) ketone **11** was treated with vinyl magnesium bromide,[19] and the resulting alcohols, **13**[16] and **14**,[16] were separated chromatographically. Reaction of **13** with OsO_4-H_2O_2[20] afforded, among other products,[21] the dihydroxy ketone **6a** (21%) which was benzoylated to **6b.** (Anal. Calcd for $C_{16}H_{20}O_6$: C, 62.33; H, 6.54. Found: C, 62.40; H, 6.42.)

Perusal of the data in Table I provides conclusive evidence that the benzoylated methyl pillaroside in entry 1 is the L-enantiomer of **6b.**[3] Furthermore, this skeleton for pillarose (**1**)[3] better accommodates the periodate oxidation analysis[2] than does **2.** This analysis will be discussed in detail in the full paper.

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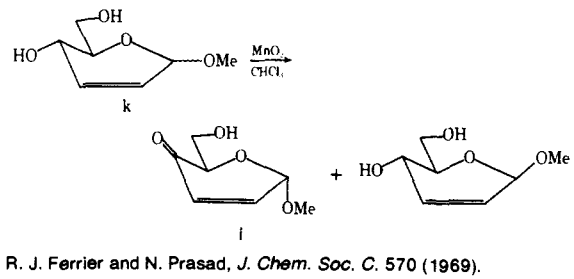
(12) Ketone **11** was readily prepared from the anomeric mixture k[13] by MnO_2 oxidation in $CHCl_3$, whereupon only the α-glycoside was oxidized[14] to enone l. The unreacted β-diol was then removed by extraction into water.



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(16) The stereochemistry at C-4 of the compounds in Scheme II was not known with certainty until compound **6b** had been finally obtained. Our choice of olefin **13** for further study was based on the observation that the H-1 ^1H NMR signal had the appearance of a doublet, such as that reported for methyl pillaroside[2] (see Table I). By contrast, H-1 in **14** was a triplet. The successful conversion of **13** to **6** confirmed these stereochemical assignments. The triplet pattern for H-1 of **5b** indicated stereochemical relationship to **14** rather than to **13.**
(17) J. G. Moffatt, *J. Am. Chem. Soc.*, **89**, 2697 (1967); **90**, 740 (1968).
(18) With Collins' reagent,[10] **12** underwent over oxidation to regenerate ketone **11.**
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(21) These products will be described in the full paper.

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CIDNP in Reactions Initiated by Tetramethyl-1,2-dioxetane

Sir:

Excited states of the carbonyl compounds produced in thermal decomposition of 1,2-dioxetanes have been identified by chemiluminescence measurement[1] and by their chemical intra-[2] or intermolecular[3,4] reactions which generally are in quite low yield.[5] Tetramethyl-1,2-dioxetane (TMD), which is most extensively investigated, is known to produce excited triplet acetone efficiently in its thermal decomposition in systems free or carefully purged of metal salts.[3] Chemically induced dynamic nuclear polarization (CIDNP) has been so well explored as to offer an independent way of characterizing the multiplicity of the radical pair responsible for the polarization. Thus the thermal decomposition or direct irradiation of benzoyl peroxide in carbon tetrachloride (via a singlet radical pair) produces an emission signal in the ^1H NMR spectrum of the product chlorobenzene, while photosensitized decomposition in carbon tetrachloride, with acetophenone as sensitizer (via a triplet radical pair), leads to chlorobenzene showing an *enhanced absorption* CIDNP signal, the reversal being associated with decomposition from the triplet rather than the singlet state.[6,7]

We have found that at 87° in carbon tetrachloride, benzoyl peroxide (0.18 *M*) is caused to decompose by a sixfold excess of TMD. Enhanced ^1H NMR absorption at δ 7.2 due to chlorobenzene was seen 15 sec after insertion of the sample into the preheated probe. The signal reached a maximal intensity after 45 sec, and disappeared after 200 sec. (In the absence of TMD no CIDNP was seen under these conditions and no perceptible decomposition of the benzoyl peroxide in 200 sec. The ^1H NMR signal of the originally 1 *M* TMD also disappeared as the enhanced absorption declined. The results were similar in chloroform-*d* at 80°, but in this case the strong enhanced absorption of benzene-*d* at δ 7.30 was accompanied by less intense emission at δ 7.23 due to phenyl benzoate. Both signals were seen 30 sec after insertion of the sample into the heated probe; both reached a maximal intensity after 105 sec. Those CIDNP spectra were also observable in the presence of 0.2 *M* TMD.

These experiments confirm that the peroxide decomposition is initiated by energy uptake from triplet acetone, as in the photosensitized BPO decomposition, in harmony with the observations cited above.[6,7] Addition of acetophenone (0.3 *M*) to our solution made no significant difference in the NMR signals seen; however, addition of 9-fluorenone or

piperylene inhibited the decomposition of BPO as well as the CIDNP phenomena. This finding is also consistent with previous observations that decomposition of BPO and hence CIDNP is not induced by use of sensitizers with E_T lower than 55 kcal/mol.[8,9] The same CIDNP spectra were also observed in oxygen-saturated chloroform-*d*, although the rate of decomposition of TMD was four times slower than in degassed solution (so CIDNP spectra were seen over a longer period) presumably on account of inhibition of chain decomposition of TMD previously observed.[10]

The opposite polarization phases in direct and photosensitized decomposition of BPO illustrate the effect of singlet vs. triplet radical pair precursors on the product. We have also encountered in the course of this work an illustration of the effect of the magnetic field on the phase of the CIDNP signal. Chlorobenzene produced by the acetophenone-photosensitized decomposition of benzoyl peroxide in CCl_4 at 30° *outside* the NMR spectrometer showed a strong emission signal, in contrast to the enhanced absorption noted by Kaptein et al.[6] under identical conditions *inside* the magnetic field. Such field dependencies are well known.[7] A striking, and yet unexplained, feature of this experiment is the persistence of our emission signal for 1 min after cessation of the illumination, whereas in the photodecomposition inside the magnetic field[6] the signal disappeared immediately on turning off the light.[11]

Dependence of the CIDNP phase on the nature of the radical pair is strikingly illustrated by the comparison of the results with benzoyl peroxide and those with *tert*-butyl perbenzoate. The chlorobenzene from the TMD-induced decomposition of *tert*-butyl perbenzoate in carbon tetrachloride gives a weak emission signal, under the same conditions that produced enhanced absorption from benzoyl peroxide. In both cases the signal reaches its maximum intensity 45–50 sec after insertion of the sample into the probe at 87°. From what is known about the *g* factors of phenyl (2.0020)[12] and *tert*-butoxy (2.009)[13] radicals, a phenyl-*tert*-butoxy radical pair would not be expected to produce this reversal of CIDNP phase. Perhaps in this case the initial pair (t-BuO··OOCC$_6$H$_5$) determines the polarization, which is impossible from the corresponding symmetrical pair from benzoyl peroxide.

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(10) Turro and coworkers[4b] have reported that this chain reaction (direct energy transfer from triplet acetone to TMD) shortens the lifetime of TMD in 1 *M* solution by a factor of about a thousand. In the same concentration range, in benzene or deuteriochloroform, we could observe a factor of only fourfold, in the presence or absence of benzoyl peroxide. As in previous observations of the chain decomposition of TMD, the reaction order changed from first toward second in the absence of oxygen.
(11) One may speculate that transfer of our sample from the light into the NMR probe dissipated any heat buildup from the irradiation while a temperature rise in the irradiated sample of ref 6 might have allowed a later slow thermal decomposition of the BPO, the emission phase of whose chlorobenzene CIDNP counteracted the residual absorption.
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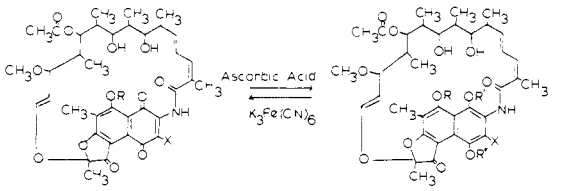
Electronegative Groups at C-3 of Rifamycin S Enhance Its Activity toward DNA-Dependent RNA Polymerase

Sir:

Rifamycin S (**1a**), a fermentation product of *Streptomyces mediterranei*,[1] is a potent inhibitor of DNA-dependent RNA polymerase (RNAP) of *E. coli* and other prokaryotes.[2] Rifamycin derivatives have also been observed to inhibit RNA-dependent DNA polymerase, but substantially higher concentrations are required in this case.[3] Little is known concerning the details of the remarkably tight interaction between the ansamycins and RNAP although it appears that covalent bond formation is not involved.[4] The potentially promising antiviral properties of these antibiotics[5] has prompted us to investigate the details of this interaction. We report here that inhibition of RNAP by 3-substituted rifamycins is (with one exception) increased by electron attracting and decreased by electron donating substituents, and that this, in all likelihood arises from a variation in k_{assoc} for the formation of the known 1:1 RNAP:rifamycin complex.[6]

Rifamycin derivatives **1f–j** were prepared by reaction of rifamycin S with the appropriate nucleophile. Halogen derivatives **1d** and **1e** were prepared by halogenation of rifamycin SV. Derivative **1c** was prepared by halide exchange of **1d**.[7]



X		R		R	R'	R'
H	1a	H, RIFAMYCIN S	2a	H	H	H, RIFAMYCIN SV
CH=N-N-CH3	1b	H	2b	H	H	H, RIFAMPICIN
Cl	1c	H	2c	H	H	H
Br	1d	H	2d	H	H	H
I	1e	H	2e	H	H	H
CN	1f	H	2f	H	H	H
NH-N-O	1g	H				
NH_2	1h	H				
$NH(CH_2)_4$	1i	H	2i	H	H	H
$SC(CH_3)_3$	1j	H				
-	1k	CH_3				

DNA-dependent RNA polymerase was isolated from *E. coli* K-12 using a modification of Burgess' procedure,[8] with final purification accomplished by means of a DNA-affinity column.[9] The purity of the isolated enzyme was determined by SDS gel electrophoresis to be at least 95%.[10] In vitro assays preincubated 26 μg of RNAP and varying amounts of antibiotic at 4°C in a 230 μl solution containing a final concentration of 40 m*M* Tris·HCl (pH 7.9), 10 m*M* $MgSO_4$, 150 m*M* KCl, 0.5 mg/ml bovine serum albumin, 0.15 m*M* UTP, GTP, CTP, and ^{14}C-ATP (2mCi/mmol), and 0.1