Comme nous l'avons déjà observé dans le cas de $\Phi_2\dot{P}{=}O$ et de $\Phi\dot{P}\!\!<^{O}_{OH}$, l'analyse des spectres RPE. de $\Phi_2\dot{P}{=}S$ ne nécessite pas la participation des orbitales d du phosphore et il semble donc qu'une simple hybridation sp^n soit satisfaisante pour décrire les systèmes radicalaires étudiés.

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152. C(8) Epimeric 8-Hydroxy-erythromycins-B

by **Paul Kurath, Jerry R. Martin, Jack Tadanier, Alma W. Goldstein, Richard S. Egan** and **Daniel A. Dunnigan**

Division of Antibiotics and Natural Products
Abbott Laboratories, North Chicago, Illinois 60064, USA

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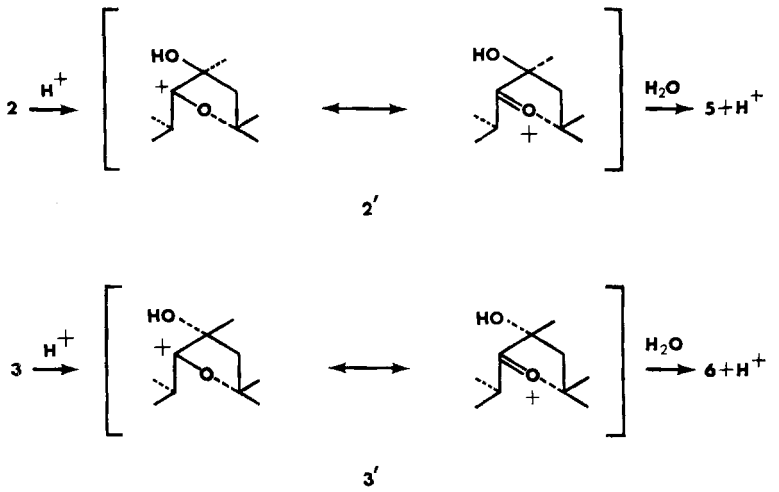
Zusammenfassung. Die gepufferte *m*-Chlorperbenzoesäure-Epoxydation von 8,9-Anhydro-erythromycin-B-6,9-hemiacetal liefert nach der Reduktion der N-Oxidgruppe stereoselektiv das (8*S*,9*S*)-8,9-Anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxid nebst einer geringen Menge des 8-*epi*-(8*R*,9*R*)-8,9-Anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxids. Die beiden Epoxide reagieren in wässeriger Essigsäure-Lösung unter Wasseranlagerung stereospezifisch zum entsprechenden (8*S*)-8-Hydroxy-erythromycin-B, beziehungsweise zum 8-*epi*-(8*R*)-8-Hydroxy-erythromycin-B.

The extension of the hydrogen peroxide/osmium tetroxide oxidation of 8,9-anhydro-erythronolide-B-6,9-hemiacetal [1] to the N-oxide of 8,9-anhydro-erythromycin-B-6,9-hemiacetal (**1**) afforded a reaction mixture which contained at least three reaction products [2]. Reduction of the above crude N-oxide mixture over Pd/C followed by separation of the reaction products by chromatography led to the isolation of three compounds which were found to be (8*S*,9*S*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**2**), 8,9-*seco*-8-oxo-erythromycin-B-9-oic-acid-6,9-lactone (**4**), and (8*S*)-8-hydroxy-erythromycin-B (**5**) [2].

We now report that a two-phase oxidation of 8,9-anhydro-erythromycin-B-6,9-hemiacetal (**1**) [3] with *m*-chloroperbenzoic acid in chloroform stirred vigorously in the presence of an aqueous 5% sodium hydrogen carbonate solution yielded, after reduction of the excess peracid with cyclohexene, and catalytic reduction of the resulting N-oxide mixture, the stereoselective oxidation product (8*S*,9*S*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**2**) together with a small amount of the diastereomeric 8-*epi*-(8*R*,9*R*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-

epoxide (**3**)[1]). In aqueous acetic acid, the epoxides **2** and **3** were stereospecifically converted to (8*S*)-8-hydroxy-erythromycin-B (**5**) and 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B (**6**), respectively[2]).

The stereospecific conversions of **2** to **5** and **3** to **6** may be explained by cleavages of the C(9) epoxide bonds of the protonated epoxides **2** and **3** to form the resonance stabilized C(8) epimeric oxonium ions **2'** and **3'** which then react with water to yield the corresponding C(8) epimeric 8-hydroxy-erythromycins-B, **5** and **6**, respectively.

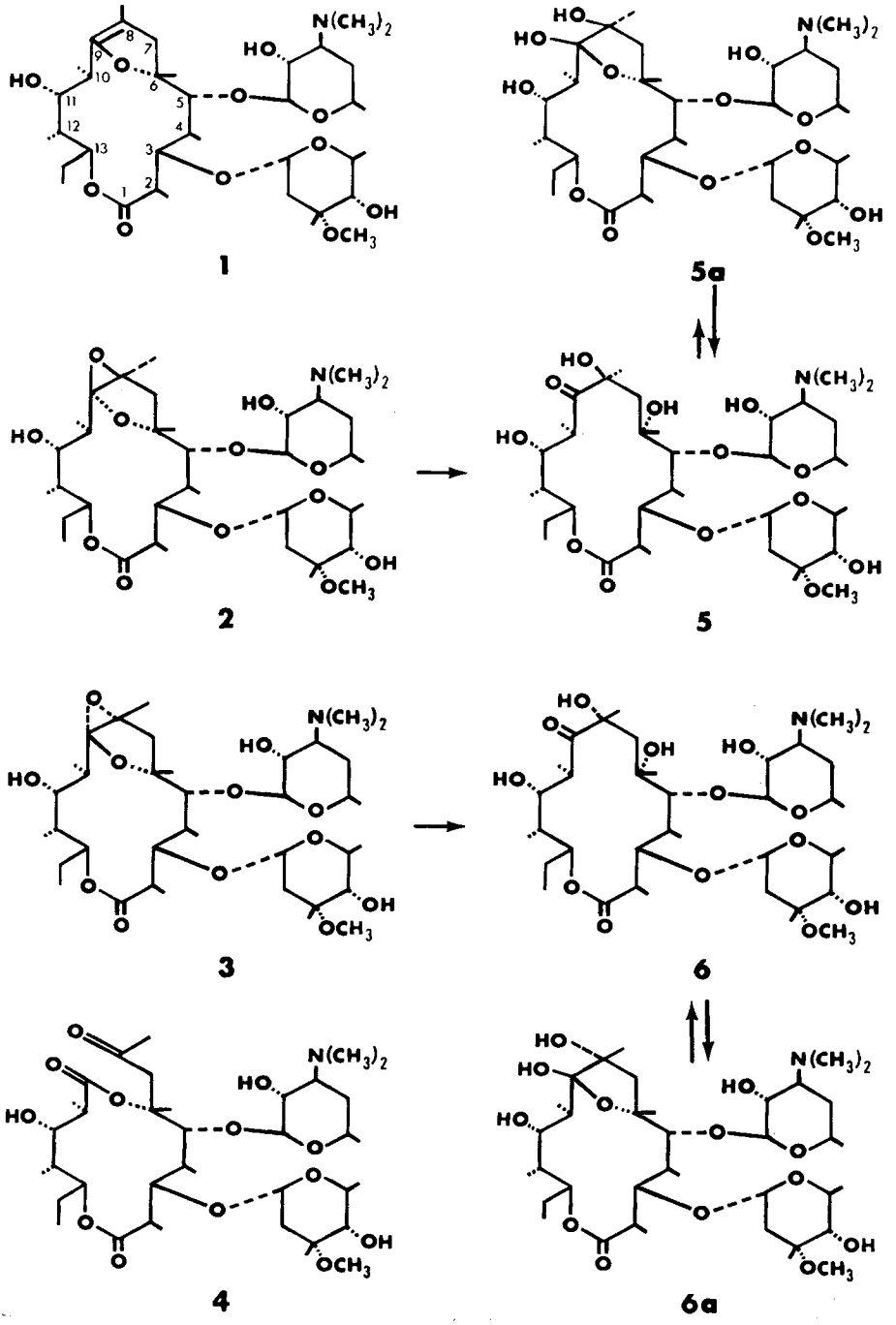


Structural Assignments. The oxidation products **2** and **3** did not exhibit UV. maxima at 209 nm characteristic of **1** [3]. This observation, together with the finding that **2** and **3** contained one more oxygen atom than **1**, led to their formulation as 8,9-epoxides. These structural assignments are analogous to that previously reported for the *m*-chloroperbenzoic acid oxidation product of 8,9-anhydro-erythronolide-B-6,9-hemiacetal [1].

The study of the 100 MHz NMR. spectra of the epoxides **2** and **3** provided evidence for the 8,9-epoxide structures assigned to these compounds. The spectra of the two products (**2** and **3**) isolated from the oxidation reaction were nearly identical. Comparison of chemical shifts and coupling constants with those of the enol ether starting material **1** (Table) revealed many striking similarities, especially in the magnitude of the aglycone ring coupling constants. The small magnitude of $J_{2,3}$ and the large value of $J_{10,11}$ in both oxidation products parallel the observed couplings in the enol ether **1**, but not in erythromycin B. These distinctive similarities require structural

[1]) The use of the prefix 8-*epi* denotes unnatural orientation of the C(8) methyl group in the erythromycin structure. The configurational notation of macrolides used in this publication is different from that used previously at positions 3, 6, 10, and 13. This change at the inward directed bonds has been made to conform to the notation used by *Celmer* [4] (*cf.* [5]).

[2]) When the epoxidation —N-oxide reduction sequence was carried out in the absence of a buffer to remove the *m*-chlorobenzoic acid generated, and without destruction of the excess peracid prior to catalytic reduction, partition column chromatography yielded directly 18% of **2**, 22% of **5**, and 5% of **6**.


1
5a
2
5
3
6
4
6a

and conformational relationships to the enol ether **1** which can only be satisfied by the epoxide hemiacetal structures **2** and **3**.

Noteworthy is the fact that there is virtually no difference in the chemical shifts of the C(6) methyl protons of the two diastereomeric epoxides, although in the case of **2** the C(6) methyl is *cis* to the anisotropic epoxide ring while in **3** the C(6) methyl is *trans* to the epoxide ring. A similar lack of dependence of the chemical shifts of the C(19) methyl resonances on the stereochemistry of the diastereomeric 5α,6α- and 5β,6β-epoxysteroids has been reported [6], however.

Examination of a molecular model of 8,9-anhydro-erythromycin-B-6,9-hemiacetal (**1**) suggested that the predominant formation of the (8*S*,9*S*)-8,9-epoxide **2** is a consequence of the favored approach of the epoxidizing reagent from the more accessible face of the 8,9-double bond of **1**. This has analogy in the kinetically controlled formation in aqueous acid of erythromycin-B from the enol ether **1** in which the protonating agent approaches from the more accessible side of the enol ether double bond [3], *i.e.*, the same side as that preferred by the epoxidizing agent. That the stereospecific conversion of **1** to erythromycin-B is indeed kinetically controlled was shown by the fact that prolonged treatment of erythromycin-B with aqueous acid led to a mixture containing almost equal amounts of erythromycin-B and 8-*epi*-erythromycin-B [5]. The minor epoxidation product of **1** is the diastereomeric 8-*epi*-(8*R*,9*R*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**3**). The acid catalyzed stereospecific conversion of the epoxides **2** (8*S*,9*S*) and **3** (8*R*,9*R*) to the C(8) epimeric 8-hydroxyketones **5** (8*S*) and **6** (8*R*), respectively, further supported the stereochemical assignments of **2** and **3**.

The NMR. spectrum of the hydroxyketone **5**, derived from the predominant epoxide **2**, exhibited two singlet methyl resonances below 1.3 ppm and an AB quartet for the C(7) methylene protons (Table) indicating that substitution at C(8) had occurred. The chemical shifts and coupling constants of the aglycone ring protons correlate well with those of erythromycin-B and thereby support a close structural similarity which is possible only if this oxidation product is an 8-hydroxy-erythromycin-B.

The NMR. spectrum of the hydroxyketone **6**, derived from the epoxide **3**, showed a duality of resonances indicative of a mixture of two components in chloroform-*d*, pyridine-d_5, or methanol-d_4 solution. In each case, and particularly in pyridine-d_5 where the effect was most pronounced, it was found that there was a temperature dependent reversible change in the proportions of the two components. This phenomenon suggested that the two components were the hydroxyketone **6** and hemiacetal **6a** tautomers of 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B. Unfortunately, the complexity of the spectrum precluded a detailed analysis of the aglycone ring proton resonances.

In a previous study [1] the invariance of the spectral parameters of erythronolide-B and (8*S*)-8-hydroxy-erythronolide-B was used as evidence for their conformational[3]) and configurational homogeneity. A similar comparison between erythromycin-B and (8*S*)-8-hydroxy-erythromycin-B (**5**) (Table) supports the conclusion that these compounds are likewise related, thereby assigning the (8*S*)-configuration to this epimer.

[3]) For discussions of macrolide conformations see Ref. [11]–[13] in [1].

Molecular models reveal that (8*S*)-8-hydroxy-erythromycin-B (**5**) suffers no destabilizing interactions which should cause a conformational change. However, epimerization of C(8) leading to the (8*R*)-8-hydroxyketone **6** creates an unfavorable *syn*-periplanar interaction between the C(6) and C(8)-*epi*-methyl groups. A conformational reorganization in which the C(6) to C(8) ring segment is flattened relieves this interaction and facilitates the formation of the five-membered ring hemiacetal **6a**. The *syn*-periplanar interaction between the C(8) hydroxyl and the C(6) methyl groups of **5**, on the other hand, would be less due to the significantly smaller size of a hydroxyl group [7].

Another case in which the hydroxyketone-hemiacetal tautomerism is affected by the configuration at C(8) is provided by the C(8) epimeric 11,12-epoxy-erythromycins-

Nuclear Magnetic Resonance Parameters

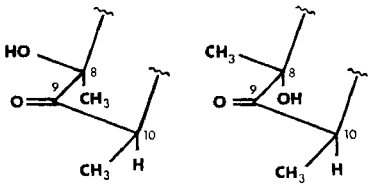
	Chemical shifts							Coupling constants					
	1	**2**	**3**	**5**	**6**	Erythromycin-B		**1**	**2**	**3**	**5**	Erythromycin-B
(2)	2.70	2.71	2.72	2.91		2.87	$J_{2,3}$	3.0	2.7	3.0	9.3	8.3
(3)	4.11	4.31	4.30	3.96		4.07	$J_{3,4}$	2.5[a]	2.7	3.0	3.0	~1
(5)	3.90	3.86	3.86	3.50		3.60	$J_{4,5}$	7.5	7.7	7.8	6.2	7.0
(7a)	2.65	2.03	2.08	2.14		2.00	$J_{7a,7e}$	14.5	13.8	13.8	[b]	15.0
(7e)	1.93	1.76	1.86	2.14		–	$J_{10,11}$	8.5[a]	7.5	8.0	1.2	~1
(10)	2.59	~3.2	~3.3	3.03		2.98	$J_{11,12}$	8.5[a]	11.2	11.2	9.5	9.8
(11)	3.34	4.15	4.23	3.84		3.83	$J_{12,13}$	1.5[a]	3.2	3.5	1.0	~1
(13)	5.16	4.60	4.62	5.39		5.35	$J_{13,14}$	7.5	6.9	7.0	8.5	9.0
							$J_{13,14}$	5.5	6.9	7.0	5.5	5.5
(1′)	4.43	4.42	4.43	4.42		4.43						
(2′)	3.19	3.19	3.18	3.29		3.21						
(1″)	5.10	5.11	5.13	4.88		4.89	$J_{1',2'}$	7.5	7.2	7.2	7.2	7.0
(4″)	3.03	3.02	3.03	2.98		3.00	$J_{2',3'}$	10.0	10.0	10.0	10.0	10.2
(5″)	4.11	4.09	4.10	4.04		4.05						
H_3(6)	1.35	1.42	1.42	1.38	1.33	1.47	$J_{1'',2a''}$	4.5[a]	5.0	5.0	4.5	4.5
H_3(8)	1.56	1.54	1.36	1.68	1.52	1.14	$J_{1'',2e''}$	1.0[a]	~1	~1	~1	1.5
					1.55		$J_{4'',5''}$	9.5	9.0	10.0	9.0	9.0
CH_3	3.35	3.36	3.36	3.30	3.26	3.32						
$(CH_3)_2$	2.28	2.27	2.28	2.29	2.27	2.30						

Measured in pyridine-d_5 solution.
Chemical shift equivalence prevents determination.

A [8]. 8-*epi*-11,12-Epoxy-erythromycin-A, which in the hydroxyketone form would have a *syn*-periplanar interaction between the C(6) and C(8)-*epi*-methyl groups, was found to exist exclusively as the hemiacetal tautomer. In contrast, 11,12-epoxy-erythromycin-A was found to be isolable as an interconvertible mixture of hydroxyketone and hemiacetal tautomers. That conformational factors other than the steric interactions between the C(6) and C(8)-*epi*-methyl groups, influence hydroxyketone-hemiacetal tautomerism, however, is indicated by the fact that 8-*epi*-erythromycin-B [5] exists exclusively as the hydroxyketone.

The UV. and CD.[4]) spectra of (8*S*)-8-hydroxy-erythromycin-B (**5**) confirmed the stereochemical assignment at C(8). The observation of a hypsochromic shift of the carbonyl absorption in the UV. spectrum of **5** (λ_{max} = 280 nm, ε = 36) relative to the corresponding absorption of erythromycin-B (λ_{max} = 288 nm, ε = 40 [9]) required that the 8-hydroxy group in **5** be equatorial [10]. The comparison of the methanol solution CD. spectra of the α-hydroxyketone **5** ($[\theta]_{283} = -9615$, $[\theta]_{218} = -3085$) and erythromycin-B ($[\theta]_{288} = -10810$, $[\theta]_{210} = -3620$ [11]) likewise supports the equatorial assignment of the 8-hydroxyl group in **5** [12] [1]. These findings, together with the NMR. evidence presented above, allow the conclusion that the (8*S*)-8-hydroxy-erythromycin-B exists in the keto form **5** rather than the hemiacetal form **5a** at ambient temperature.

An end absorption in the UV. spectrum of 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B (**6**) around 300 nm precluded the observation of the keto carbonyl absorption. However, the cyclohexane solution CD. spectra of **6** ($[\theta]_{295} = -4254$, $[\theta]_{228} = -2500$) and 8-*epi*-erythromycin-B [5] ($[\theta]_{290} = -11676$)[5]) revealed the expected bathochromic shift of the keto carbonyl absorption [12] of the axial α-hydroxyketone **6** when compared to the corresponding 8-*epi*-erythromycin-B keto carbonyl absorption. Due to the tautomerism between the keto form **6** and the hemiacetal form **6a** which was manifested in the NMR. spectra of 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B (**6**) only the position and sign of the CD. curve are significant, but not the intensity. The partial conformational structures **5'** and **6'** illustrate the stereochemical relationships at C(8) of **5** and **6**.



5' **6'**

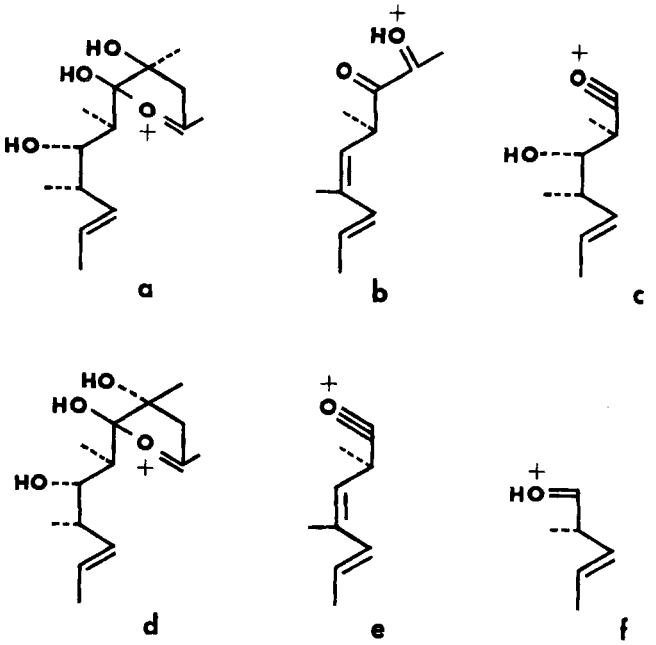
In the mass spectra of the C(8) epimeric 8-hydroxyketones **5** and **6** the molecular ions at *m/e* 733 exhibited signals of low intensity which could not be peak matched. The high resolution spectra of **5** and **6** further supported the structural assignments of these substances. The ions **a** ($C_{14}H_{25}O_4$; 1.36%) and **d** ($C_{14}H_{25}O_4$; 0.67%) of *m/e* 257 arose by α-cleavages of the 5,6-bonds of the *McLafferty*- rearrangement products of the molecular ions[6]) of the hemiacetals **5a** and **6a**, respectively. The sequential loss of two molecules of water from **a** and **d** resulted in fragments at *m/e* 239 ($C_{14}H_{23}O_3$; 3.81% and 3.08%, respectively) and at *m/e* 221 ($C_{14}H_{21}O_2$; 0.86% and 1.49%, respectively). The ions **b** of *m/e* 181 ($C_{11}H_{17}O_2$; 0.50%) derived from the rearranged hydroxyketone **5** by α-cleavage of the 7,8-bond and dehydration, together with the observa-

[4]) The authors are indebted to Drs. *L. A. Mitscher* and *G. W. Clark* of the Ohio State University, Columbus, Ohio 43210, USA, for recording and interpretation of the circular dichroism spectra.

[5]) The CD. maximum of the lactone carbonyl could not be observed.

[6]) All the ions of particular interest for the structure proof arose from the *McLafferty*-rearrangement ions of **5** and **6**. The rearrangement was formulated in footnote[2]) of [1]; see also [13].

tion of a signal for **c** of *m/e* 155 ($C_9H_{15}O_2$; 0.43%) arising from a similar cleavage of the 8,9-bond, clearly located the newly introduced hydroxyl group of **5** at C(8). The ions **b** of *m/e* 181 ($C_{11}H_{17}O_2$; 0.27%) and **e** of *m/e* 137 ($C_9H_{13}O$; 0.22%) which resulted from the electron impact fragmentation of the *McLafferty*-rearrangement product of the molecular ion of **6** located the additional hydroxyl group of the latter at C(8). Other fragments which were indicated in the mass spectra of **5** and **6** arose from α-cleavages of the C, C-bonds next to functional groups of the macrolide ring such as the ion **f** of *m/e* 99 ($C_6H_{11}O$) the signal of which was observed in the spectra of both **5** and **6** in relative abundances of 7.27% and 5.74%, respectively, as well as fragments arising from the sugar residues [13].



Biological activity. Compounds **2–6** had poor *in vitro* antimicrobial activity against a variety of micro-organisms. (8*S*)-8-Hydroxy-erythromycin-B (**5**) had about 15% of the activity of erythromycin-B against *Staphylococci*, while 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B (**6**) was almost inactive.

The authors are indebted to Mrs. *Sandra L. Mueller* for mass spectra, to Mrs. *Ruth Stanaszek* for assistance in obtaining the NMR. spectra, to Mr. *W. H. Washburn* for the IR. spectra, to Mr. *J. Raihle* for the UV. spectra, to Mr. *J. B. Holland* for assistance with the catalytic hydrogenations, to Mrs. *Julie Hood* for microanalysis, and to Mrs. *Esther Hirner* for technical assistance. We thank Mrs. *Charlene Vojtko* for biological results. We wish to thank Dr. *P. Beak* and Dr. *L. A. Mitscher* for stimulating discussions.

Experimental Part

General Remarks. Melting points were taken on a *Fisher-Johns* melting point apparatus. UV. spectra were recorded with methanol solutions employing a *Beckman Acta 5* spectrophotometer using the expanded scale. Optical rotations were measured in methanol solutions with a *Hilger* and *Watts* polarimeter. IR. spectra were recorded in deuteriochloroform solutions on a *Perkin-*

Elmer Model 521 grating spectrometer. CD. spectra were obtained with a *Durrum-Jasco* Model ORD/UV-5 instrument equipped with a CD. attachment and operating at ambient temperatures in spectral grade solvents. Mass spectra were recorded with an *A.E.I.* MS-902 mass spectrometer with an ionization energy of 70 eV; samples were introduced into the source by a direct inlet system. NMR. spectra were determined at 100 MHz using a *Varian* HA-100 spectrometer in deuteriochloroform unless stated otherwise; chemical shifts were reported in ppm from internal tetramethylsilane (O δ), and coupling constants were reported in Hz. Silica gel 60 (*Merck*, Darmstadt) was used in the partition chromatography [14].

m-*Chloroperbenzoic Acid Oxidation of 8,9-Anhydro-erythromycin-B-6,9-Hemiacetal* (**1**). To a stirred solution of 4.04 g of 8,9-anhydro-erythromycin-B-6,9-hemiacetal (**1**) in 100 ml of chloroform was added 160 ml of 5% aqueous sodium hydrogen carbonate. A freshly prepared solution of 4.06 g of *m*-chloroperbenzoic acid in 50 ml of chloroform was added dropwise to the vigorously stirred mixture. After stirring at room temperature for 21 h. a solution prepared from 10 ml of cyclohexene and 40 ml of chloroform was added dropwise. Stirring was continued for 5 h.; the resulting mixture was shaken with a solution of chloroform and 5% aqueous sodium hydrogen carbonate. The chloroform extract was washed with water, the chloroform was evaporated under reduced pressure, and the last traces of chloroform were removed by co-distillation with benzene under vacuum[7]) to leave 3.90 g of a mixture of (8*S*,9*S*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide and 8-*epi*-(8*R*,9*R*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide as the N-oxides.

A solution of 3.79 g of the crude N-oxide mixture in 250 ml of ethanol was reduced over 1.20 g of 5% Pd/C. The catalyst was collected on a filter and the resulting ethanol solution was treated with Darco G 60 and filtered through a Celite mat. The filtrate was concentrated to about 50 ml under reduced pressure, and shaken with a mixture of 400 ml of chloroform and 300 ml of 5% aqueous sodium hydrogen carbonate. The chloroform solution was washed with water and the organic solution was evaporated under reduced pressure to yield 3.71 g of a white foam. A part of the latter, 3.60 g, was chromatographed on a partition column (5.8 cm × 70 cm) to yield 0.20 g of pure 8-epi-(8R,9R)-*8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide* (**3**) in the early fractions. The compound had $[\alpha]_D^{24} = -41°$ ($c = 1.04$); $\tilde{\nu}_{max}$ 3630–3360 (broad, irregular), 1718 cm^{-1}; no UV. maximum between 200 and 350 nm. A sample was recrystallized from methanol/water: m.p. 205–206°.

$C_{37}H_{65}NO_{12}$ (715.898) Calc. C 62.07 H 9.15 N 1.96% Found C 62.17 H 9.43 N1.96%

Further elution of the column and evaporation of the fractions resulted in the isolation of 1.52 g of (8S,9S)-*8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide* (**2**). This product was crystallized from methanol/water to yield 1.24 g of **2**, m.p. 228–230°. A part of this substance was recrystallized from methanol and dried under high vacuum at 137° for analysis: m.p. 228–229°; $[\alpha]_D^{24} = -26°$ ($c = 0.97$); $\tilde{\nu}_{max}$ 3610, 3560, 3440 (broad), 1725 cm^{-1}; no UV. maximum between 200 and 350 nm.

$C_{37}H_{65}NO_{12} \cdot CH_3OH$	Calc.	C 61.02	H 9.29	N 1.87 O 27.81%
(747.940)	Found	,, 61.03	,, 9.36	,, 1.84 ,, 27.98%

(8S)-*8-Hydroxy-erythromycin-B* (**5**). To a freshly prepared solution of 0.60 g of (8*S*,9*S*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**2**) in 10 ml of acetic acid was added 10 ml of water, and the reaction mixture was allowed to stand at room temperature for 4 h. The above solution was slowly added to 150 ml of a saturated sodium hydrogen carbonate solution containing excess solid potassium carbonate. The resulting mixture was extracted with two 100-ml portions of chloroform. The combined chloroform solution was washed with three 75-ml portions of water, dried over anhydrous magnesium sulfate, filtered, and evaporated to leave 0.60 g of crude (8*S*)-8-hydroxy-erythromycin-B (**5**). The substance was purified by silica gel partition chromatography. Elution of the column (3.5 cm × 75 cm) and evaporation of the fractions containing **5** gave a colorless residue which was dissolved in 50 ml of chloroform and the residual inorganic salts were removed by three washes with 50-ml portions of water. The chloroform solution was dried over anhydrous magnesium sulfate, filtered, and evaporated to leave 0.45 g of pure **5**.

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[7]) The presence of chloroform during hydrogenation results in the formation of hydrochloric acid [15] in quantities which in some cases caused degradation of erythromycin derivatives.

Crystallization from ether/hexane gave an analytical sample, m.p. 210–212°; $[\alpha]_D^{25} = -74°$ ($c = 1.07$); $\tilde{\nu}_{max}$ 3607, 3540 (broad), 3450 (broad), 1723 cm^{-1}; λ_{max} 280 nm ($\varepsilon = 36$).

$C_{37}H_{67}NO_{13}$ (733.914) Calc. C 60.55 H 9.20 N 1.91% Found C 60.35 H 9.26 N 1.75%

8-epi-(*8*R)-*8-Hydroxy-erythromycin-B* (**6**) was prepared by treatment of 8-*epi*-(8*R*,9*R*)-8,9-anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**3**) with aqueous acetic acid as described above for the preparation of **5**. 8-*epi*-(8*R*,9*R*)-8,9-Anhydro-erythromycin-B-6,9-hemiacetal-8,9-epoxide (**3**) (0.20 g) thus treated afforded after partition chromatography 0.11 g of pure 8-*epi*-(8*R*)-8-hydroxy-erythromycin-B (**6**) as a colorless foam; $[\alpha]_D^{24} = -55°$ ($c = 1.03$); $\tilde{\nu}_{max}$ 3630–3300 (broad, irregular), 1707 cm^{-1}; the UV. spectrum showed only end absorption around 300 nm and a shoulder at 280 nm ($\varepsilon = 45$).

$C_{37}H_{67}NO_{13}$ (733.914) Calc. C 60.55 H 9.20 N 1.91% Found C 60.31 H 9.42 N 1.77%

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153. Etude conformationnelle dans l'approximation CNDO/BW: barrière de rotation interne de petites molécules organiques

par **Jacques Weber** et **Raymond Gerdil**

Département de Chimie Organique, Université de Genève,
30, quai de l'Ecole-de-Médecine, 1211 Genève 4

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Summary. The potential functions for internal rotation of several representative small organic molecules are calculated by the CNDO/BW method. For ethane, methanol, propylene, methylcyclopropane and ethylene the most stable conformation is predicted correctly, although too small a value is calculated for the height of the rotational barrier, with the exception of ethylene