EVENTEENTH NATIONAL ORGANIC
CHEMISTRY SYMPOSIUM
of the
AMERICAN CHEMICAL SOCIETY

Auspices of the Division of Organic Chemistry
Indiana University and the Southern Indiana Section

*

June 25-29, 1961
Bloomington, Indiana

SEVENTEENTH NATIONAL ORGANIC CHEMISTRY SYMPOSIUM

of the

AMERICAN CHEMICAL SOCIETY

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Headquarters and Registration: Indiana University Auditorium

Sunday, June 25, 2:00 p.m. to Midnight

Monday, June 26, 8:00 a.m. to 8:00 p.m.

Tuesday, June 27, 8:00 a.m. to 8:00 p.m.

Wednesday, June 28, 8:00 a.m. to 8:00 p.m.

Thursday, June 29, 8:00 a.m. to 12:00 Noon

Meetings: Indiana University Auditorium

N2

Speakers at the Seventeenth National Organic Chemistry Symposium

1961


R. Breslow


D. F. DeTar


M. J. S. Dewar


G. S. Hammond


W. S. Johnson


N. J. Leonard


K. L. Rinehart, Jr.


G. A. Russell


J. C. Sheehan


W. E. Truce


E. Wenkert


H. E. Zimmerman

Herbert O. House
1.00 Net 1-30-64

Program

Monday, June 26

9:00 a.m. Welcome. RALPH COLLINS, Vice President and Dean of Faculties, Indiana University
Response. WILLIAM E. PARHAM, Chairman, Division of Organic Chemistry, A.C.S.
9:30 a.m. N. J. LEONARD, "Ethylenimonium Compounds—Synthesis and Chemistry."
10:30 a.m. Discussion of Paper 1
11:00 a.m. M. J. S. DEWAR, "Heteroaromatic Boron Chemistry."
12:00 a.m. Discussion of Paper 2
2:00 p.m. R. BRESLOW, "The Stability of Some Cyclic Conjugated Ions."
3:00 p.m. Discussion of Paper 3
3:30 p.m. H. E. ZIMMERMAN, "A Mechanistic Approach to Organic Photochemistry."
4:30 p.m. Discussion of Paper 4
7:00 p.m. Reception—Lawn, President's House
8:30 p.m. Organ Recital—Auditorium

Tuesday, June 27

9:00 a.m. W. S. JOHNSON, "Stereochemical Factors in the Angular Alkylation of Fused Ring Ketones."
10:00 a.m. Discussion of Paper 5
10:30 a.m. G. S. HAMMOND, "Organic Chemistry of Triplet States."
11:30 a.m. Discussion of Paper 6
Tuesday p.m. No Formal Program Scheduled
8:00 p.m. R. B. WOODWARD, Roger Adams Medal Award Address, "Recent Advances in the Chemistry of Natural Products."

Wednesday, June 27

9:00 a.m.	D. F. DETAR, “Diacyl Peroxides.”
10:00 a.m.	Discussion of Paper 7
10:30 a.m.	G. A. RUSSELL, “Autoxidation in Basic Media.”
11:30 a.m.	Discussion of Paper 8
2:00 p.m.	J. C. SHEEHAN, “Amide Reactions.”
3:00 p.m.	Discussion of Paper 9
3:30 p.m.	E. WENKERT, “Current Chemical Studies on Organic Natural Products.”
4:30 p.m.	Discussion of Paper 10

Thursday, June 28

9:00 a.m.	K. L. RINEHART, Jr., “Antibiotic Structural Studies.”
10:00 a.m.	Discussion of Paper 11
10:30 a.m.	W. E. TRUCE, “Stereoisomeric Vinylic Sulfides (Some Syntheses and Configurational Determinations).
11:30 a.m.	Discussion of Paper 12

12:00 Noon—ADJOURN

LADIES PROGRAM

Monday, June 26

2:00 p.m.	Tour of I. U. Union
3:30 p.m.	Tea in University Club Lounge
7:00 p.m.	Reception—Lawn, President’s House
8:30 p.m.	Organ Recital—Auditorium

Wednesday, June 28

Visit to Rustic Nashville and Brown County

THE ROGER ADAMS AWARD IN ORGANIC CHEMISTRY

The Roger Adams Award in Organic Chemistry was established with joint sponsorship by the American Chemical Society, Organic Reactions, Inc. and Organic Syntheses, Inc. The award is made biennially to an individual, without regard to nationality, for outstanding contributions to research in organic chemistry. The award consists of a medal and an honorarium of five thousand dollars. The presentation of the award is made at the biennial National Organic Symposium of the Division of Organic Chemistry of the American Chemical Society, and the recipient will deliver a lecture as part of the program of the Symposium. ✓

This award recognizes the distinguished career of Roger Adams. He has played a vital role in each of the three organizations sponsoring the award, having been both Chairman of the Board of Directors and President of the American Chemical Society and a co-founder of both *Organic Syntheses* and *Organic Reactions.*

The award committee has chosen Professor R. B. Woodward of Harvard University, as this year's recipient of the Roger Adams Award in Organic Chemistry. His award address is entitled, "Recent Advances in the Chemistry of Natural Products."

ROGER ADAMS

R. B. WOODWARD

Bloomington Committees

★

Indiana University and the Southern Indiana Section of the American Chemical Society are acting as hosts

Committees in Charge

General	E. Campaigne and V. J. Shiner, Jr.
Housing and Registration	Indiana University Conference Bureau—H. G. Day, Liaison Officer
Local Arrangements	W. Meyer, J. Thoma and Members of Omega Chapter, P.L.U.
Transportation	C. E. Kaslow and W. H. Nebergall
Ladies Program	Mrs. Jean Campaigne, Miss Joanna Dickey, Mrs. Valeta Kaslow and Mrs. Reva Shiner
Chairman, Southern Indiana Section	C. Austin

Division of Organic Chemistry

The programs of this and preceding symposia were based on balloting by the members of the Division approximately one and one-half years prior to each symposium. The plans of the Seventeenth National Organic Chemistry Symposium have been developed by the members of the Executive Committee of the Division of Organic Chemistry who have served during the past two years.

	1959-1960	**1960-1961**
Chairman	John C. Sheehan	William E. Parham
Chairman-Elect	William E. Parham	Stanley J. Cristol
Secretary-Treasurer	Herbert O. House	Herbert O. House
	William E. Truce	William E. Truce
	Marshall Gates	DeLos F. DeTar
	DeLos F. DeTar	George S. Hammond
	George S. Hammond	Carl Djerassi
		Kenneth B. Wiberg

An Invitation to Organic Chemists who are not members of the Division of Organic Chemistry

The Executive Committee of the Division of Organic Chemistry extends to you a cordial invitation to become a regular member of the division.

Each of the divisions of the American Chemical Society serves a field of specialization and the Organic Division endeavors to serve organic chemists by furthering organic chemistry. To that end, it wishes to have associated with it as many organic chemists as possible.

The requirements for divisional membership are: (1) membership in the American Chemical Society, (2) active interest in organic chemistry, and (3) payment of annual dues of $2.00. These dues are used to pay the expenses involved in the activities of the division which are:

1. Mailing of notices and forms for the presentation of papers at the Spring and Fall Meetings of the A.C.S.
2. Lithoprinting and distributing to members abstracts of the papers to be presented, in advance of the national meetings.
3. Arranging for National Symposia on organic chemistry. These are held every two years and the speakers and program are determined by the members of the Organic Division.
4. Establishing and promoting policies vital to the advancement of organic chemistry.

If you wish to become a regular member of the Organic Division, all that is necessary is to give or send your name, mail address, and $2.00 to:

HERBERT O. HOUSE, Secretary
Organic Division, A.C.S.
Department of Chemistry
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

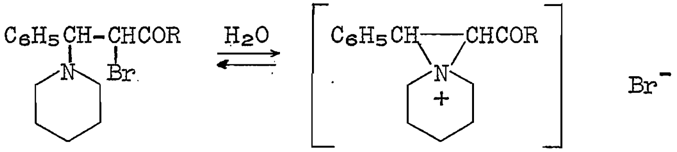
Extra copies of this Symposium Abstract Booklet can be obtained at $1.00 each from the Secretary.

ETHYLENIMONIUM COMPOUNDS-
SYNTHESIS AND CHEMISTRY

N. J. LEONARD

Postulation of an Ethylenimonium Ion (Aziridinium Ion) as an Intermediate

In reactions of β-amino-α-bromoketones--



Conducting; immed. ppt.
with $AgNO_3$

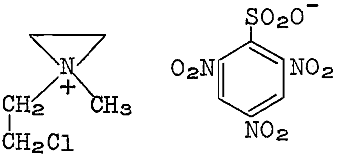
N. H. Cromwell and D. J. Cram, J. Am. Chem. Soc., 65, 301 (1943).
N. H. Cromwell and I. H. Witt, J. Am. Chem. Soc., 65, 308 (1943).

In reactions of β-chloroethylamines (nitrogen mustards)--

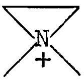
See A. Gilman and F. S. Philips, Science, 103, 409 (1946) for an abstract of the work of many researchers during 1942-1945.

Evidence for the formation of the ethylenimonium ion--

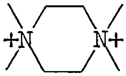
(1) $$\mathrm{MeN(CH_2CH_2Cl)_2} \xrightarrow[\text{pH 8}]{\mathrm{H_2O}\ \text{30 min.}} \xrightarrow[\text{sulfonate}]{\text{sodium picryl-}}$$



(2) Reaction with $S_2O_3^{=}$:



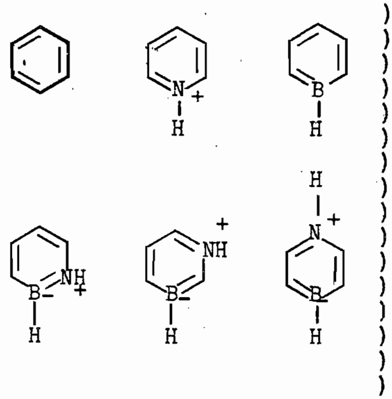
vs.



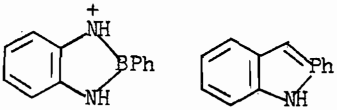
HETERAROMATIC BORON CHEMISTRY

M. J. S. Dewar

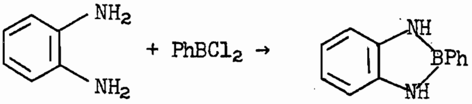
B^- C N^+ are isoelectronic

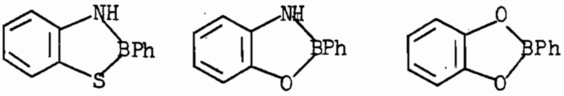


isoconjugate



isoconjugate





(1) relatively stable to hydrolysis

(2) spectra similar to those of normal aromatic analogues.

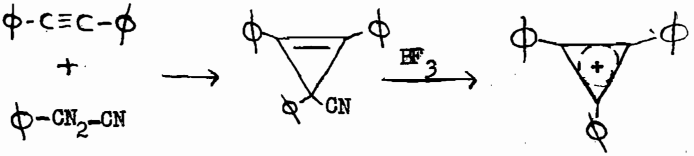
THE STABILITY OF SOME CYCLIC CONJUGATED SYSTEMS

R. BRESLOW

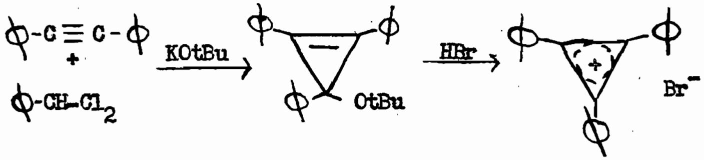
1. Cyclopropenyl cations.

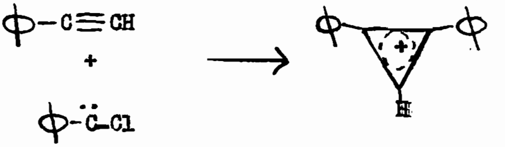
It is predicted by simple Huckel m.o. calculations that derivatives of the cyclopropenyl cation will be aromatic systems. The purpose of our work in this area has been to synthesize such derivatives and to examine their properties, with the hope of testing both qualitative and quantitative aspects of the m.o. predictions.

a. Early synthesis of the triphenylcyclopropenyl cation (R. Breslow, J. Am. Chem. Soc., 79, 5318 (1957); R. Breslow and C. Yuan, ibid., 80, 5991 (1958)):



b. Convenient synthesis (with H. Chang):





(with J. Lockhart)

A MECHANISTIC APPROACH TO ORGANIC PHOTOCHEMISTRY

Howard E. Zimmerman

Organic photochemistry, although the subject of many investigations dating back to the nineteenth century and now the object of especially intensive efforts, has in general lacked the mechanistic sophistication of ground state organic chemistry, and not without reason. Whereas in ordinary organic reactions one knows the gross and electronic structure of the reactant, in photochemistry the actual reactant undergoing structural change is an excited state most often of unknown electronic structure.

Organic chemistry itself has received powerful impetus from the rarely stated but generally recognized principle that for a successful reaction there must be available a continuous, preferably low energy, electron redistribution process. Consideration of a set of organic reactants in light of this principle allows, at a minimum, prediction of the various possible products.

Application of the principle of continuous electronic redistribution to photochemistry is indeed possible, for the photochemically excited species, despite its high energy, does not react indiscriminately. However, use of the principle does require information bearing on the electronic structure of the excited state.

Several years ago the author and coworkers embarked on a series of investigations, both theoretical and experimental, designed to provide a better understanding of photochemical reactions by relating the electronic structure of excited states to observed photochemical reactions. Some of these results and ideas are presently described.

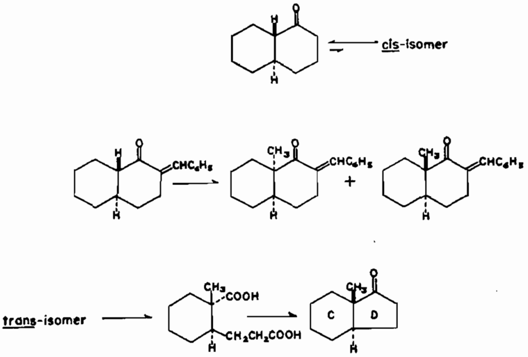
Two general types of photochemical excitation and excited states are of special importance, the n→Pi* and the Pi→Pi* processes and states. Of the two, the former is more readily described and will be discussed first.

The weak band at ca 270-330 mmu in the ultraviolet spectrum of ketones was first interpreted by Mulliken as arising from promotion of a non-bonding, or unshared, electron to the antibonding Pi (i.e. Pi*) orbital of the carbonyl group. Wheland

STEREOCHEMICAL FACTORS IN THE ALKYLATION OF FUSED RING KETONES

William S. Johnson

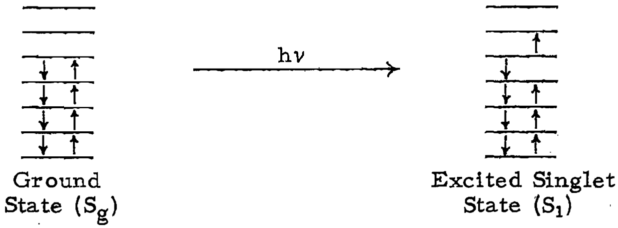
Basically this problem concerns the stereochemical fate of a nucleophile in an S_N2 process. In the studies to be reported, the nucleophile is a ketocarbanion which on alkylation generates a new asymmetric center α to the keto group. A major objective is to discover how to control the stereochemical course of this reaction so as to realize a high degree of stereoselectivity for application to the synthesis of fused ring natural products carrying angular substituents. Another objective is to obtain information on the geometry of the transition state in the S_N2 process.



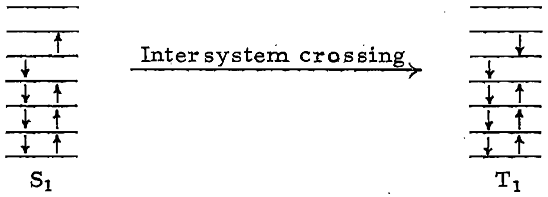
ORGANIC CHEMISTRY OF TRIPLET STATES

George S. Hammond

Most organic molecules contain even numbers of electrons. Ordinarily these electrons occupy molecular orbitals (which may be localized or delocalized) in pairs, with antiparallel spins. There are always a number of unfilled orbitals that are unoccupied because they are at higher energy levels. By absorption of light, electrons can be excited from occupied to unoccupied levels. The direction of an electron spin cannot be changed during the absorption process.



Both states are singlets because the electrons in the molecules possess no net angular momentum. Corresponding to the excited state, S_1, there will always be another state in which the spin of the promoted electron (or the one left behind) is reversed. Such a molecule will have an electronic magnetic moment, and the energy level will be split into three levels in a magnetic field. Such a state is a triplet.



Singlet → triplet conversions are "forbidden". This means that they are observed in absorption spectroscopy only under exceptional circumstances. The reverse process, $T_1 \rightarrow S_g$, with emission of light may be observed as long-lived phosphorescence if a molecule is trapped in the T_1 state. Nonradiative decay of T_1 to S_g is also much slower than thermal degradations, which conserve spin, e. g. $S_2 \rightarrow S_1$ or $T_2 \rightarrow T_1$. Relationships involved in the decay of excited states produced by light absorption can be summarized by a Jablonski diagram.

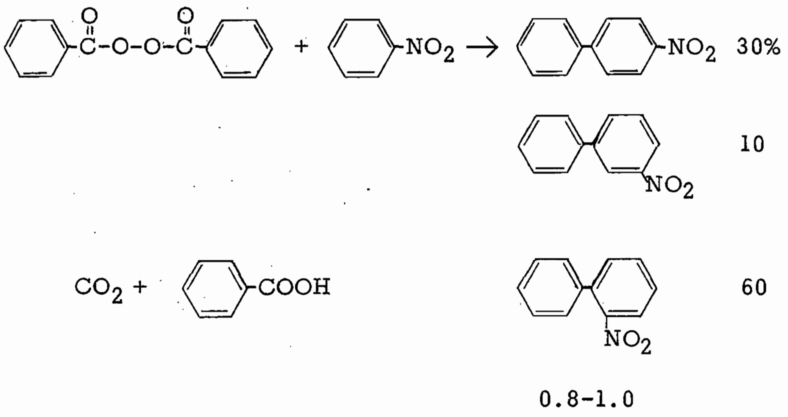
(NOTE: No abstract for RBW appears in the program book.)

DIACYL PEROXIDES

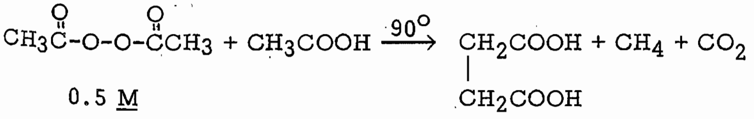
DeLos F. DeTar

Typical Examples of Diacyl Peroxide Reactions

1



2



$$CH_3\overset{O}{\overset{\|}{C}}-O-O-\overset{O}{\overset{\|}{C}}CH_3 + CH_3COOH \xrightarrow{90^{\circ}} \begin{array}{l} CH_2COOH \\ | \\ CH_2COOH \end{array} + CH_4 + CO_2$$

0.5 $\underline{M}$

0.50 1.47 1.53

CH_3 groups 80% + CH_3COOCH_3

CO_2 groups 80 0.05

M. S. Kharasch and M. T. Gladstone, J. Am. Chem. Soc., <u>65</u>, 15 (1943).

AUTOXIDATION IN BASIC MEDIA

Glen A. Russell

in collaboration with Edward Janzen,
Anthony Moye, Krishen Nagpal, Frank
Smentowski

Abstraction of hydrogen atoms by peroxy radicals is drastically retarded by the close proximity of powerful electron-withdrawing substituents. These same substituents promote the ionization of alpha hydrogen atoms thereby making the autoxidation of the resulting carbanions an attractive alternative. In the presence of alkoxide ions and in an appropriate solvent the following typical reactions occur (R = p-nitrophenyl).

$$\begin{array}{lcl}
RCH_3 & \xrightarrow{\text{low } O_2 \text{ pressure}} & RCH_2CH_2R \\
RCH_3 & \xrightarrow{\text{high } O_2 \text{ pressure}} & RCO_2H \\
RCH_2OH & \longrightarrow & RCO_2H \\
RCH_2CH_2R & \longrightarrow & RCH{=}CHR \\
R_2CH & \longrightarrow & R_2C{=}O \\
R_2CHOH & \longrightarrow & R_2C{=}O \\
R_3CH & \longrightarrow & R_3COOH + R_3COH \\
R_2CHZ & \longrightarrow & R_2C{=}O + ZO^-
\end{array}$$

All of the reaction products are readily explained by a free radical mechanism wherein the product controlling reactions are:

$$\begin{array}{lcl}
R\cdot + R\cdot & \longrightarrow & R{-}R \\
R\cdot + O_2 & \longrightarrow & ROO\cdot \\
R\cdot + O_2 & \longrightarrow & HOO\cdot + \text{unsaturate}
\end{array}$$

Radicals with powerful electron-withdrawing substituents, such as p-nitrobenzyl or diphenylcyanomethyl, can couple in the presence of significant amounts of oxygen. These radicals are much less reactive toward oxygen than normal alkyl or aralkyl radicals. This suggests that in the reaction of oxygen with alkyl radicals a pronounced polar effect must exist.

AMIDE REACTIONS

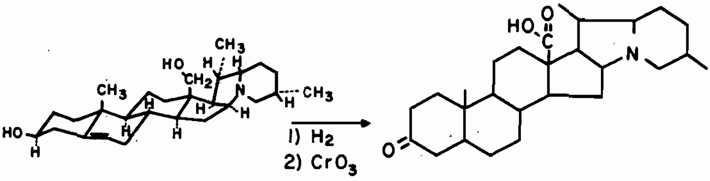
John C. Sheehan

C(16)-C(18) Rearrangements of Steroid Alkaloids

with Philip A. Cruickshank

Richard L. Young

SOLANIDANE-18-OIC ACID PREPARATION

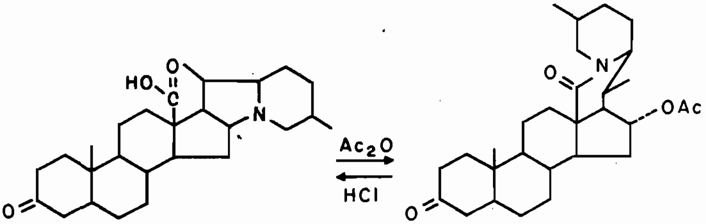


ISORUBIJERVINE

SOLANIDANE-3-ONE-18-OIC ACID

Y. Sato and W. A. Jacobs, J. Biol. Chem., 191, 63(1951)

REVERSIBLE C(16)-C(18) REARRANGEMENT



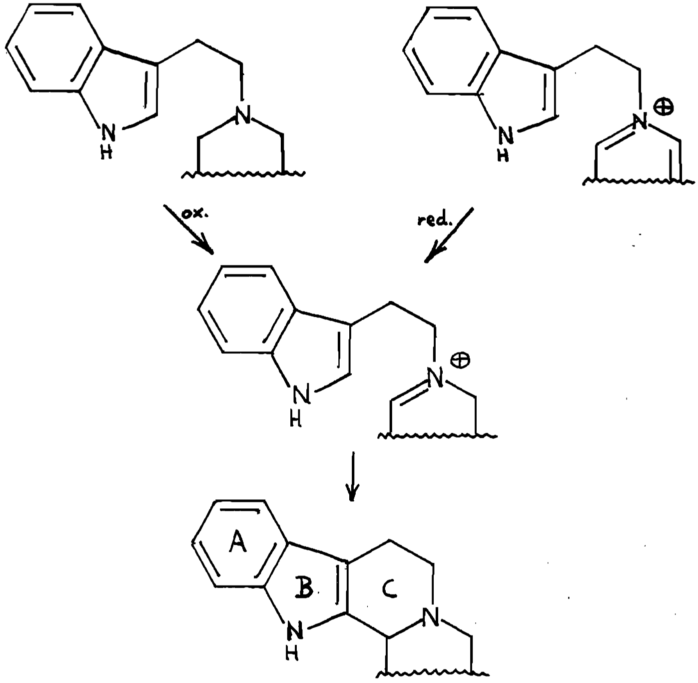
SOLANIDANE-3-ONE-18-OIC ACID

16α-ACETOXY-18-OXOCEVANIDANE-3-ONE

CURRENT CHEMICAL STUDIES ON ORGANIC NATURAL PRODUCTS

Ernest Wenkert

A discussion of one phase of continuing studies on the total synthesis of indole alkaloids at Iowa State University is presented. General methods for the construction of ring C in tetra- and penta-cyclic alkaloid systems according to the following formal representation and developed by Drs. B. Wickberg and R. A. Massy-Westropp, and Mr. J. Kilzer are described.

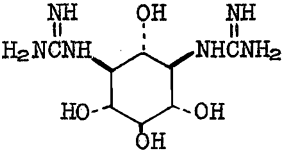


ANTIBIOTIC STRUCTURAL STUDIES

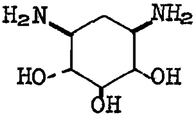
Kenneth L. Rinehart, Jr.

THE NEOMYCINS

Many antibiotics--macrolides, polyenes, aromatics, the streptothricins--contain unusual aminosugars as minor structural components. A number of others, however, consist almost entirely of aminosugar fragments; the first of these to be investigated were the streptomycins, characterized by the streptidine nucleus (I), to which are attached other carbohydrate entities. In recent years an increasingly numerous group of antibiotics have been demonstrated to contain the deoxystreptamine nucleus (II), with other fragments attached. Members of this group are listed in the following table; additional antibiotics (*e.g.*, framycetin, streptothricins BI and BII, dextromycin, fradiomycin, flavomycin, aminocidin, hydroxymycin and catenulin) have been shown to be identical to compounds in the table.



I



II

DEOXYSTREPTAMINE ANTIBIOTICS

	Discovery	Structure
Neomycins	Waksman and Lechevalier, 1949	
Paromomycin	Parke-Davis, 1956	Haskell, French, Bartz, 1959
Kanamycins	Umezawa, *et al.*, 1957	Cron, Hooper, Lemieux, *et al.*, 1958
Zygomycins A	Tatsuoka, Shibata, *et al.*, 1960	

The neomycin complex consists of two water-soluble, amorphous isomers (B and C), each containing six primary amino groups and seven hydroxyl groups. "Neomycin A" was a former name of the degradation product neamine.

STEREOISOMERIC VINYLIC SULFIDES
(Some Syntheses and Configurational Determinations)

William E. Truce

In investigating stereoselective syntheses of vinylic type sulfides, one finds that some of the usual physical methods used for determining cis-trans configurations have marked limitations when applied to these structures. For instance, dipole moments can deviate from calculated values due both to steric hindrance to certain conformations (particularly for cis arrangements), and to possible resonance interactions as between trans sulfide and carbethoxyl groups: *cis*-$\mathrm{ArSCH{=}CHSAr}$ (dipole moment calcd. 2.49 D., found 2.61 D.), *trans*-$\mathrm{ArSCH{=}CHSAr}$ (2.36, 2.37), *cis*-$\mathrm{ArSCH{=}CHCO_2Et}$ (2.59, 2.47), *trans*-$\mathrm{ArSCH{=}CHCO_2Et}$ (2.44, 2.64), *cis*-$\mathrm{ArSO_2CH{=}CHCO_2Et}$ (5.18, 4.50), *trans*-$\mathrm{ArSO_2CH{=}CHCO_2Et}$ (5.00, 5.03); Ar = p-tolyl.

Also, infrared data is complicated by the occurence of skeletal vibrations in useful regions of the spectra and by marked shifts in useful group frequencies that result from the presence of the sulfur substituents. For example, both *cis* and *trans*-$\mathrm{ArSCH{=}CHSAr}$ exhibit C=C stretching at 1550 cm^{-1} (6.45 μ) whereas the usual range for this absorption lies above 1600 cm^{-1} (6.25 μ). The *trans* CH out of plane deformation band, normally located at approximately 960-970 cm^{-1} (10.3 μ) seems to appear in these vinylic sulfides in the wide range of 915-965 cm^{-1} (10.3-11.0 μ) and its utility is severely reduced by the occurrence of several skeletal absorptions in the same region. (See also Boonstra and Rinzema, Rec. trav. chim. 962 (1960).) Although the in-plane CH deformation band was indeterminate for some of these sulfides, this mode proved useful for acrylic acid and ester derivatives; this absorption appeared as a sharp band at 1350 cm^{-1} only in the *cis* isomers.

A particularly valuable physical measurement for configurational determinations for unsymmetrically disubstituted ethylenes is N.M.R., e.g., J_{HH} for *cis*-$\mathrm{ArSCH{=}CHCO_2H}$, 9.7 c.p.s.; trans acid, 15.4; *cis*-$\mathrm{ArSCH{=}CHCO_2Et}$, 10.4; trans ester, 14.9.

B. Groten, Purdue, Ph.D. Thesis, 1961.

One approach to the stereoselective synthesis of vinylic-type sulfides involves nucleophilic replacement of halide from an olefinic center by a thiolate reagent. As pointed out by several groups of workers over the past few years, such replacements can proceed by several different reactions paths, including the following: