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Deadline Dates:
No. 109: 7 October 1967
No. 110: 6 November 1967

Reminder: For the period August 10, 1967 to August 15, 1968 inclusive, all Newsletter contributions, enquiries, etc., should be addressed as follows:

Dr. Bernard L. Shapiro
Department of Chemistry
Stanford University
Stanford, California 94305

- continued on outside back cover
COMPUTING IN NMR - SENIOR RESEARCH ASSOCIATE WANTED

Dear Barry,

I would like to use the columns of IITNMR to advertise that I am seeking a suitable person to fill the above position. The job involves co-ordinating and developing Computer Applications to NMR and is held in association with the Science Research Council Atlas computer at Chilton, berks. The appointment is for two years.

I am looking for someone with a lot of initiative, since part of the task is to establish a library of efficient programs, covering the whole range of NMR, as part of the Atlas system. This means contacting scientists with working programs, as well as writing new routines. A good mathematical background is desirable, but prior knowledge of computing is not essential. The position would be ideal for a chemist wishing to gain experience in computing (where the highly-paid jobs are these days!). Someone of post-doctoral status (or of similar experience) would be preferred. There are also plenty of individual NMR research problems that are waiting to be tackled using computation. The salary scale is £1105 - £1340 per annum, with F.S.S.U. benefits. Commencement of the job would be by mutual arrangement, preferably this Autumn. Anyone is welcome to write for further details.

Best wishes,

Robin

R. K. Harris.

P.S. As I am not suggesting this letter should be counted as my IITNMR "contribution" (see the letter by Leuterbur, and sundry imprecations by Shapiro in number 106) I hope it can be "accepted for publication" without demur!!
August 7, 1967

Dr. Bernard L. Shapiro
Department of Chemistry
Stanford University
Stanford, California 94305

Dear Dr. Shapiro,

SOLVENT EFFECTS IN THE N.M.R. SPECTRUM OF 1,2,7,7-TETRACHLORONORBORNANE

N.m.r. spectra of the title compound have been obtained for 10% w/w solutions in benzene, pyridine, and chloroform; these spectra are shown in the accompanying diagram.

Of particular interest is the contrast between the appearance of the A2B2 pattern in benzene and in chloroform, and the fact that the spectrum in pyridine more closely resembles the corresponding spectrum in chloroform than that in benzene. A change in the ratio (Δν/J) is expected with change in solvent; however, it is not clear why the spectra in the aromatic solvents should differ so radically.

We would very much appreciate hearing from IITMRN readers who have encountered similar behavior in AB or A2B2 systems, and who might be able to offer some suggestions to explain our observations.

Sincerely yours,

Alan P. Marchand

William R. Weimar Jr.
11B-NMR-Spektren von einigen neuen Derivaten des Dekaborans

Sehr geehrter Herr Professor Shapiro!

Wir haben neuerdings unseres 80 MHz-Geräts (konstruiert von Dr. J. Dadok) mit üblichen Raffinessen ausstatten können und es ist nun für 1H-Untersuchungen bestens geeignet. Unlängst haben wir mit diesem Gerät auch einige 11B-Untersuchungen bei 20 MHz durchgeführt. Wir haben die Stellung der Substituenten bei einigen neuen Dekaboranderivaten, und zwar bei FB\textsubscript{10}H\textsubscript{13}, ClB\textsubscript{10}H\textsubscript{13}, BrB\textsubscript{10}H\textsubscript{13}, IB\textsubscript{10}H\textsubscript{13} und (B.\textsubscript{10}H\textsubscript{13})\textsubscript{2}O, die unlängst dar,estellt wurden, bestimmt.


<table>
<thead>
<tr>
<th>Substanz</th>
<th>ppm</th>
<th>$^{11}_{\text{B}}$-H-Kopplungskonstanten für B-2 und B-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - FB\textsubscript{10}H\textsubscript{13}</td>
<td>56,5</td>
<td>166</td>
</tr>
<tr>
<td>6 - ClB\textsubscript{10}H\textsubscript{13}</td>
<td>50,5 ; 57,6</td>
<td>155 ; 129</td>
</tr>
<tr>
<td>5 - BrB\textsubscript{10}H\textsubscript{13}</td>
<td>54,2</td>
<td>155</td>
</tr>
<tr>
<td>5 - IB\textsubscript{10}H\textsubscript{13}</td>
<td>51,7</td>
<td>165</td>
</tr>
<tr>
<td>6-6' - O(B.\textsubscript{10}H\textsubscript{13})\textsubscript{2}</td>
<td>51,9 ; 60,2</td>
<td>170 ; 162</td>
</tr>
</tbody>
</table>

Mit vielen herzlichen Grüßen

(Z. Samek)
(P. Sedmá)
$^3$-NMR-Spektren

Lei: 2.0 MHz

a) $6-\text{CP~B}_{10} \text{H}_{13}$

b) $5-\text{Br~B}_{10} \text{H}_{13}$

(ohne Referenzsignal)
Isotopic Effects on Chemical Shifts in the Hydrogen Molecule

We have recently taken up again the problem of isotope shifts of nuclear shieldings in molecular hydrogen (see L. R. Anders, J. D. Baldeschwieler and P. C. Lauterbur, IITNMRN 84-1 (September 1965)). Initial results and some plans are outlined below.

Ramsey suggested that such effects could be calculated if the chemical shift (σ) were expressed as a function of internuclear distance R and then the ∑R averaged over the appropriate vibrational states. Some calculations of this kind were done some years ago by Marshall. We have employed an expression for ∑R derived from a Wang function by Sinha and Mukherji. Following Marshall, we obtained a power series expansion (1) in the neighborhood of R_e, the equilibrium internuclear distance.

\[ \sigma_R = \sigma_{Re} + c_1 (R-R_e) + c_2 (R-R_e)^2 + \ldots + c_6 (R-R_e)^6 \]

The calculation was performed on an IBM 7044 computer and the effective nuclear charge which appears in the Wang function was adjusted as a function of internuclear distance with the values computed by Hirschfelder and Linnett. The average shielding was calculated from (2)

\[ \sigma_{ave} = \sigma_{Re} + c_1 (R-R_e) + c_2 (R-R_e)^2 + \ldots + c_6 (R-R_e)^6 \]

using the values of (R-R)_n for H₂, HD and D₂ obtained by Chan, Ikenberry and Das from a truncated Morse potential. The results are presented in the Table below.

<table>
<thead>
<tr>
<th>Isotope shifts (ppm)</th>
<th>exp.</th>
<th>Marshall²</th>
<th>Saika and Narumi³</th>
<th>This work</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-D</td>
<td>0.04±0.01²</td>
<td>0.025</td>
<td>0.036</td>
<td>0.0386</td>
</tr>
<tr>
<td></td>
<td>0.035±0.008⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.036±0.002⁵</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D₂-HD</td>
<td>0.048±0.037⁶</td>
<td>0.030</td>
<td>0.043</td>
<td>0.0460</td>
</tr>
</tbody>
</table>
To Dr. Bernard L. Shapiro  
August 15, 1967  
Page 2


Our calculated values can be seen to be in good agreement with the available experimental and semi-empirical results. The details of the calculations indicate that the isotopic shifts are very sensitive functions of the internuclear potential, and care must be taken to keep sufficient terms in the expansion to insure convergence to the correct value.

We are now measuring the D₂-HD shift in hopes of getting a significant improvement on Wimett's accuracy. The shifts in HT, DT and T₂ are being calculated also, and we challenge our more intrepid readers (G. V. D. Tiers, are you still with us?) to obtain the experimental data.


Very truly yours,

[Signature]

Theodore Vladimiroff

[Signature]

Paul C. Lauterbur
August 15, 1967

Dear Barry:

Several months ago we published work (J. Am. Chem. Soc., 89, 1438 (1967) extending the linear relation between bond order and vicinal coupling constants for a variety of olefins, diolefins, aromatics, and nonbenzenoid aromatics with both six and five membered rings. In searching for other systems where these relations might be of interest, I recently collected the m.o. bond orders and NMR data available for a series of six-membered heterocycles. These data are plotted in the accompanying figure; the line shown being that for the six-membered carbocyclics.

The vicinal coupling constants in these systems will be functions of other variables than the bond order. The electronegativity of the heteratom is of importance. From considerations of some vinyl amines the effect of nitrogen vs. carbon seems to require the addition of ca. 2 c.p.s. for bonds $\alpha$, $\beta$ to nitrogen. This correction has been made in the plot. Changes introduced by altered HCCH angles also need to be considered and may explain why furan, pyrrole, and thiophene do not fall well on the five-membered plot even with reasonable electronegativity corrections. The bond angle correction for nitrogen in six-membered rings does not appear to be significant.

Considering the variety of sources for the NMR data and bond orders (all the way from simple HMO to fancy SCF) the fit seems remarkably good and potentially useful.

Best regards,

Bill

W. B. Smith
Chairman
Department of Chemistry

Enclosure
Professor Bernard L. Shapiro  
Department of Chemistry  
Stanford University  
Stanford, California 94305

Dear Barry:

Analysis of a Complex Chemical Equilibrium with the aid of B-11 Magnetic Resonance.

In conjunction with a study on the mechanism of the hydroboration reaction, we have been forced to study the disproportionation reactions of trialkylboranes with borane in tetrahydrofuran solution. A satisfactory interpretation of the initial results on the basis of the following three equilibria could not be realized. What had initially appeared to be a rather simple system

\[
\begin{align*}
R_3B + BH_3 & \rightleftharpoons R_2BH + RBH_2 \\
2R_2BH & \rightleftharpoons RBH_2 + R_3B \\
2RBH_2 & \rightleftharpoons R_2BH + BH_3
\end{align*}
\]

has turned out to be quite complex - and a real challenge to completely analyze.

The B-11 resonance spectra of the equilibrated mixtures looked like ill-defined blobs! Heteronuclear decoupling (H) produced reasonably well resolved spectra which indicated the presence of $R_2BH$ and $RBH_2$ being present in both monomeric and dimeric form. This required us to consider the following five equilibria ($BH_3$ and $R_3B$ are monomeric). The data from two equilibrated mixtures

\[
\begin{align*}
BH_3 + RBH_2 & \rightleftharpoons \text{H-bridged dimer} \\
BH_3 + R_2BH & \rightleftharpoons \text{H-bridged dimer} \\
2RBH_2 & \rightleftharpoons \text{H-bridged dimer} \\
RBH_2 + R_2BH & \rightleftharpoons \text{H-bridged dimer} \\
2R_2BH & \rightleftharpoons \text{H-bridged dimer}
\end{align*}
\]
for each R system were analyzed by a complex computer routine giving what we feel are quite reasonable values for these five equilibrium constants. We are now attempting to calculate the rate constants involved in the three disproportionation equilibria.

It is obvious from this investigation that any approach to the study of the hydroboration reaction may be beset with many problems involving such equilibria.

With best regards,

Daniel J. Pasto
Associate Professor of Chemistry

DJP:dw
THE AA'(BB')(BB') SPIN SYSTEM: CYCLOBUTANONE

Bill Fairless and I have recently completed an analysis of the proton NMR spectrum of cyclobutanone. We undertook the project because we thought it would be a valuable test for our HA-100 spectrometer and would teach us a little about machine computation of spectra. Unfortunately we were unable to solve the problem completely using 100 MHz data as well as extensive spin-tickling. We had to obtain 60 and 40.5 MHz data to supplement the 100 MHz information. We did find out a good deal about symmetry in this rather complex spin system and have written the results for publication. A very limited number of pre-prints are available.

We have summarized the values that gave calculated spectra which fit at all three frequencies in the appended table. In addition, a diagram showing the nomenclature we have used for cyclobutanone is included.

Sincerely,

M. R. Willcott
Assistant Professor of Chemistry

Enclosure
CYCLOBUTANONE

NMR PARAMETERS DETERMINED FROM 100, 60, 40.5 MHz SPECTRA

\[ \begin{align*}
\nu_B &= 2.93573 \\
\nu_A &= 1.86036 \\
J_{GCO} &= -17.576 \\
J_{CL} &= 2.497 \\
J_{TL} &= -2.283 \\
J_C &= 10.066 \\
J_T &= 6.351 \\
J_G &= -11.750
\end{align*} \]
Dear Barry:

Our present objective is to obtain information concerning the binding sites of a number of enzymes by direct observation of the resonances of the macromolecule. Even the higher frequency spectrometers with superconducting magnets are not expected to provide spectra subject to unambiguous interpretation in most cases due to the inevitable overlap or large numbers of broad peaks. Therefore, we are in the process of preparing a selectively protonated deuterio-enzyme as a model system. However, useful information has been obtained for some small proteins (MW ≈ 15,000) at 100 Mc, viz. bovine pancreatic ribonuclease A, staphylococcal (Foggi) nuclease, and hen egg white and human lysozymes. The imidazole C-2 proton resonances of the four histidine residues of ribonuclease and staphylococcal nuclease and the single histidine residues of the two lysozymes have been clearly resolved. Plots of the shifts of these peaks as a function of pH give an individual titration curve and pK for each histidine residue. In ribonuclease the pK values are 5.6, 6.0, 6.2, 6.6; in staphylococcal nuclease 5.6, 5.9, 6.1 and 6.6; in HEG lysozyme 5.8; and in human lysozyme 7.5, reflecting differences in protein structure.

Addition of nucleotide inhibitors to ribonuclease causes selective shifting and broadening of at most two of the four histidine C-2 peaks. These two correspond to the two titration curves which are also grossly shifted in the 3-carboxypropyl histidine-12 ribonuclease. This tends to confirm the assignments of these two peaks as His 12 and 119, and is consistent with previous data of their proximity and involvement in the binding site. Preliminary data with 1-carboxypropyl histidine-119 ribonuclease indicates that the same two peaks are affected, but to a lesser extent. It should be noted, however, that in both derivatives all the titration curves are affected to some extent, indicating a conformational
change in the molecule as a result of the single substitution. This might be expected since it is known from the X-ray crystallographic structure that the His 12 and 119 are within the cleft forming the active site of the molecule. Such a result underscores the limitations of any technique requiring structural modification of an enzyme as a means of obtaining information on structure and binding.

The presence of inhibitors does not affect the histidine regions of the spectra of staphylococcal nuclease or hen egg white lysozyme. The formation of the inhibitor-hen egg white lysozyme complex did, however, result in sharpening of the aromatic region of the spectrum, indicating dissociation of enzyme aggregates. One histidine C-2 peak of staphylococcal nuclease (which has an absolute requirement for Ca$^{2+}$) has been found to shift downfield by 16 cycles/sec upon addition of Ca$^{2+}$. The positions of the other three peaks were only slightly affected by Ca$^{2+}$.

Titration curves determined in H$_2$O and D$_2$O have been found to be almost superposable, indicating that the pK$_H$ (direct meter reading) is the same (± 0.2 units) in both cases i.e. \( pK_H^{20} = pK_H^{2°} \) and that the enzyme conformation in the histidine regions is not significantly different in the two solvents. The actual pK$_H^{20}$ should be obtained by the addition of 0.4 units$^3$ due to the constant deuterium isotope effect at the glass electrode.$^4$

Regards,

(Mrs.) Donella H. Meadows

John L. Markley

Jack S. Cohen

Oleg Jardetzky

Refs.
Air Mail

DR. BERNARD L. SHAPIRO
Department of Chemistry
Stanford University
Stanford, California 94305

Dear Dr. Shapiro:

Mr. Perry Hood and myself have recently re-investigated the NMR of polypeptide solutions (cf. Bovey et al. J. Polymer Sci. 38, 73 (1959)) with particular attention to the \( \alpha \)-helix-random coil transition. We have studied both the right-handed helix of poly-\( \gamma \)-benzyl-L-glutamate and the left-handed helix of poly-\( \beta \)-benzyl-L-aspartate, with d-chloroform as the helix-supporting solvent and trifluoroacetic acid (TFA) as the helix-breaking solvent. Polymers of ca. 50 and ca. 1000 peptide units length have been used in each case. Both the glutamate and aspartate helices behave in essentially the same manner, except that the transition occurs at much lower TFA concentration in the latter, indicating its lower stability. The chemical shifts of the main-chain and side-chain protons as a function of TFA concentration are shown in Figs. 1 and 2. The main-chain protons (NH and \( \alpha \)-CH) show the largest changes in shielding as we pass through the transition (at ca. 20% TFA for glutamate and 3% TFA for aspartate helices), and they move in opposite directions. Similar results have been reported for poly-L-alanine (Stewart et al., Biochemistry 6, 143 (1967)). The position of the transition was independently confirmed by circular dichroism measurements on the same solutions. The dashed lines correspond to fractions of the polymer which are too short to sustain a helix or which undergo the transition at lower TFA levels than the rest. In these regions, the spectra show two \( \alpha \)-CH and NH peaks, but these must correspond to non-exchanging spin populations, as the lifetimes of the helix and coil in equilibrium are less than \( 10^{-5} \) sec. (Lumry et al. Biopolymers 2, 489 (1964).)

In chloroform, the linewidths of all peaks are very broad and depend strongly upon molecular weight. The high molecular weight polymers appear to give virtually no spectrum, only the
phenyl resonance being discernible at all (linewidth ca. 250 cps). This extreme broadening is due to the nematic liquid crystalline nature of these solutions. Addition of TFA well short of the helix-coil transition breaks up the nematic structure and causes great narrowing of the peaks, which still are markedly dependent upon molecular weight, as would be expected for rod-like helices. The transition itself causes a further but relatively much smaller line narrowing. In the random coil state, segmental motion dominates the nuclear relaxation, and linewidths are independent of molecular weight. Fine structure due to NH-α-CH vicinal coupling becomes evident. We believe, with Stewart et al. (above reference), that the function of TFA is not to protonate the peptide groups but to form hydrogen bonded complexes which reduce helical stability.

Very truly yours,

F. A. BOVEY
Head
Polymer Chemistry
Research Department

MH-1519-FAB-sjs

Att.
Figures 1 and 2
Figure 1 - DP 55
THE CHEMICAL SHIFT OF METHYLENE PROTONS ADJACENT TO A HETEROCYCLIC QUARTERNARY NITROGEN

Dear Dr. Shapiro,

We recently had cause to investigate compounds in which a methylene group is situated between a heterocyclic quarternary nitrogen and an aromatic or ester group. It was interesting, though not unexpected, to find that such protons were sufficiently deshielded to appear in the aromatic region of the spectrum. On looking through the literature available to us we found very few examples of methylene groups in this situation. It seemed reasonable, therefore, to list these and compare their chemical shifts in various solvents.

The deshielding effect of the substituents is decreased by more polar solvents. The spectra listed below were obtained on an A60 spectrometer.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Solvent</th>
<th>CH₂ Chem. Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>![N+Br⁻</td>
<td>Cl⁻</td>
<td>CDCl₃</td>
</tr>
<tr>
<td>CH₂.CH₃</td>
<td>DMSO</td>
<td>5.07</td>
</tr>
<tr>
<td>D₂O</td>
<td>5.17</td>
<td></td>
</tr>
<tr>
<td>![N+Cl⁺</td>
<td>Cl⁻</td>
<td>Cl₃</td>
</tr>
<tr>
<td>CH₂COOCH₃</td>
<td>DMSO</td>
<td>4.30</td>
</tr>
<tr>
<td></td>
<td>D₂O</td>
<td>/contd.</td>
</tr>
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<td>Compound</td>
<td>Solvent</td>
<td>CH₂ Chem. Shift</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>-----------------</td>
</tr>
<tr>
<td>[Pyridinium] Cl'</td>
<td>CDCl₃</td>
<td>3.63</td>
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<tr>
<td>CH₂'COOC₂H₅</td>
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<td>DMSO</td>
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<td></td>
<td>D₂O</td>
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<td>[Pyridinium] Cl'</td>
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<td>CH₂</td>
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<td>[Pyridinium] Br'</td>
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<td>[Pyridinium] Cl'</td>
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<td></td>
<td>D₂O</td>
<td>3.93</td>
</tr>
</tbody>
</table>

Yours sincerely

A.A. Wagland
Dear Dr. Shapiro,

We have spent quite a lot of time over the past two years in trying to understand why the Pople-Santry method gives good values for the meta and para proton coupling constants in benzene. What are the important delocalization terms?

Starting with a basis of localized C-H and C-C MO's constructed from the usual hybrids, one can introduce delocalization terms between these, which we will generalise as $\beta'$. One can now set up a perturbation expansion for the atom-atom polarizability having the form

$$\pi_{\mu\nu} = \frac{A \beta'^2}{\beta^3} + \frac{B \beta'^3}{\beta^4} + \ldots$$

The leading term was obtained a couple of years ago (Murrell and Gil, Theoret. Chim. Acta, 4, 114 (1966); Pople and Santry, Mol. Phys., 2, 311 (1965)) and for the ortho coupling it gave good agreement to the full MO calculation. For the meta and para coupling, however, it gave a negligible contribution.

We have now sorted out the second terms and their details are in a paper just submitted for publication. We find these now give good agreement for the meta protons but are still a small part of the para coupling. The conclusion seems to be that long range coupling in the Pople-Santry theory is due to the combined effect of moderately large delocalization terms through several intervening bonds rather than the effect of just one or two small long range delocalization terms between the distant C-H bonds.

Yours sincerely,

J.N. Murrell
Magnetic Fish: Prevention and Cure

Dear Dr. Shapiro:

A problem which we frequently encounter as a result of running samples prepared by others (never in our own!) is the mysterious appearance of some small (and some not-so-small) particles of ferromagnetic material—possibly through some little understood mechanism of spontaneous generation. These magnetic fish usually play havoc with a well-tuned spectrometer—at least in proportion to their size and numbers, though some would argue for a much more complex relationship.

The idea of removing these particles from samples by fishing them out with a magnet is not a new one; however, it may be of interest to some that there is at least one supplier of very thin Alnico V magnets (1/16" x 4"). These magnets are thin enough so that they may be sealed into a long, glass tube to protect both the magnet and the sample. By attaching a handle of 1/8" glass cane of suitable length, the fishing rod may be inserted to the bottom of a standard NMR tube containing 0.3 to 0.5 ml. of sample without spilling sample, dissolving the magnet, or breaking the tube.

In order to convince our friends that we do not introduce these magnetic fish from our solvents (horrors, never!), we also keep small, glass-enclosed magnetic beetles in each of our solvent containers. These are made up from 1/8" x 1/4" magnets which we obtained from the same supplier.

For those difficult-to-reach places, namely the business end of the spherical-type microcells at the end of a long, thin capillary, we grit our teeth and insert a piece of steel piano wire (usually 0.007" x ca. 7" or 8") so it reaches to the bottom of the cell. Then the cell containing sample, fish, and wire are placed in the magnetic field to magnetize the wire. Removal of the wire usually takes out most, if not all, of the magnetic material on the first try. Of course, this technique is limited to samples and solvents which are unreactive towards steel wires. (Added bonus—the same size wire doubles nicely for cleaning recorder pen tips.)

Sincerely yours,

Lois J. Durham

* "centerless ground" Alnico V magnets, 1/16" x 4" were obtained from the Dowling Magnet Co., 2472 Teagarden, San Leandro, Calif.; price in lots of 1 to 5 is $2.75 each. The 1/8" x 1/4" pieces run $.30 each. No, we do not have stock in the company.
Short Title: Relaxation Effects in Dk spectra at sub-tickling strengths.

Dear Prof. Shapiro,

We are sorry for the delay in sending our contribution and thank you for the reminder. We have now in operation a frequency-sweep-homonuclear-double-resonance set-up on our Varian NMR-100 spectrometer. The features of this otherwise standard setup are: (1) The field-frequency locking is done using the 2kc. Audio oscillator and lock-in-detector available in the Integrator. (2) A GR-1304-B Audio Oscillator is used for modulation in the observing channel. This is a good stable oscillator and furthermore, has a linear frequency increment dial (upto 100 cps) which can be conveniently driven to sweep through the spectrum. An EMC [Electronics Missiles and Communications Inc., 262 East Third St., Mount Vernon New York] Model RJB lock-in amplifier is used in this channel. This lock-in-amplifier comes made for specific frequencies, but can be easily modified for broad-band operation needed for this channel (essentially by eliminating the Twin-Tee cans in the circuit).

Double resonance experiments were performed on an AB system (2,6-dibromoaniline). The single and double resonance spectra are shown in the enclosed photograph. (We apologize for the poor photograph. We had to try making it ourselves as we faced some passive resistance from our photographing section here). The δ and J are 38.8 and 7.7 cps respectively. The DR spectrum which shows a marked change in relative intensities is obtained with a γE/2π of about 0.03 cps which one might call a sub-tickling strength. We are at present solving the density-matrix equations in the weak-irradiation limit and hope to report the findings pretty soon.

Yours Sincerely,

Anil Kumar
(B.D. Nageswara Rao)

P.S: BDNR is reminded of many happy memories about his good old JDB gang: on seeing your new mailing address.
Subject: Modified LAOCOON Computer Program

To: Dr. Bernard L. Shapiro
Department of Chemistry
Stamford University
Stamford, California 94305

Dear Dr. Shapiro:

In the course of our computer analyses of NMR spectra, it was found desirable to make several modifications on Part I of the LAOCOON II Fortran Program. These modifications do not alter the method of computation, but rather present additional treatments of the computer spectrum output which were found to result in a substantial reduction in time required for interpretation.

Basically, these modifications are: 1) the compilation of a compressed table of ordered lines and, 2) the presentation of a printer display plot of the further compressed spectrum.

The compressed spectrum is obtained by combining lines which are degenerate in frequency or have frequencies within a 0.10 cycle interval. A number of lines so combined is printed just to the left of the line number which is taken as the number of the first summed line in that group. The resulting frequency is obtained by RMS average of the frequencies and intensities of the combined lines. The value of intensity is the sum of the individual intensities of the combined lines.

The program then tabulates the spectrum in one-half cycle increments and plots the resulting display. The resulting plot has been found most valuable in evaluating parameter assignments. Instructions for the preparation of data cards for this modified program and a complete listing are available in the form of an AFML Technical Report (AFML-TR-66-196). These reports are available upon request.

Roger E. Rondeau
ROGER E. RONDEAU
HUGHEY A. RUSH
Exploratory Studies Branch
Materials Physics Division
AF Materials Laboratory

* New Address: Chemstrand Research Center
Durham, North Carolina

1917 - 50 YEARS OF MATERIALS PROGRESS - 1967
August 30, 1967

Dr. Bernard L. Shapiro
Department of Chemistry
Stanford University
Stanford, California 94305

Dear Barry:

It may be of interest to some that the venerable Superstabilizer, which is a galvanometer with photocell amplifier, can be replaced by modern solid state low drift operational amplifiers, at least in field-frequency lock applications.

We use the Philbrick Researches, Inc. P65A voltage amplifier followed by the P66A current amplifier (booster), which supplies a pair of coils (#24 wire, 2000 turns each) in series on the magnet poles. (No doubt the Superstabilizer coils would do.) The ±15 volts are supplied by two Dynage, Inc. D-14.6-0.150 solid state power supplies. The feedback resistor network shown allows a 10:1 adjustment of dc gain. There is, of course, considerable gain in the rf and phase sensitive detector circuits preceding these dc amplifiers. The 4 μf capacitor and 10K resistor are a loop stabilization network.

Sincerely yours,

Edward B. Baker
Physical Research Laboratory, 1712

Title: Replacement of a Superstabilizer with Low Drift, Trouble Free, Solid State Operational Amplifiers
Dear Barry:

Some Newsletter readers may be interested in a workshop which we are planning for next January. The preliminary program is described in the following material, although the lineup of speakers is not necessarily final. Anyone who might wish to attend may secure further information and an application blank by dropping me a note.

Yours,

Wallace S. Brey, Jr.

Advanced Workshop and Seminar in Nuclear Magnetic Resonance
Conducted by:
Department of Chemistry of the University of Florida
Division of Continuing Education of the University of Florida

With the assistance of Varian Associates.

Dates: Monday, January 22, through Friday, January 26, 1968.

Location: Gainesville, Florida. Lectures and classes will be conducted in the new Student Union Building. Laboratories will be held in Leigh Hall and the Chemistry Research Building.

Participants: Attendance will be limited to persons with experience in the field, and preferably participants should be actively working in the area. The number will be restricted to approximately 45. The typical participant will be one with some years of practical experience, who wishes to gain a better theoretical background so that he may expand his insight into nuclear resonance phenomena and extend the scope of his research activities. The program will also afford opportunity for interchange of information on recent developments between scientists at an advanced level.

Content: The aim is to provide advanced training and instruction in the mathematical and theoretical aspects of magnetic resonance for persons using this technique. Primary emphasis will be on nuclear resonance, although electron resonance and electron nuclear double resonance may be dealt with briefly.

The following topics will be included:
(1) Mathematical methods of interpreting high-resolution spectra.
(2) Methods of signal enhancement.
(3) Study of rate processes.
(4) Relaxation times and spin echo methods.
(5) Spectra of oriented molecules.
(6) Double resonance methods, homonuclear and heteronuclear; spin decoupling and spin tickling.
(7) Use of computers in relation to the above areas.

Two to four lectures will be scheduled for each of the five days. A substantial amount of time will be spent in practice sessions with the participants engaged in self-study or in discussion under the direction of a discussion leader. Laboratory demonstrations and practice will be provided, with principal emphasis on various types of spin decoupling and spin tickling. There will be opportunity for participants to use the University of Florida IBM-360 computer.

Staff: Director, Wallace S. Brey, Jr., Professor of Chemistry, University of Florida.
Assistant Director, Katherine N. Scott, Research Associate, University of Florida.
Coordinator, W. T. Corran, Jr., Educational Director, Division of Continuing Education.

Lecturers:

Dr. Ray Freeman, Varian Associates
Dr. Charles S. Johnson, Jr., University of North Carolina, Chapel Hill.
Dr. Lawrence C. Snyder, Jr., Bell Laboratories, Murray Hill, N. J.
Dr. J. D. Swalen, IBM Research Laboratory, San Jose, California.
Dr. D. L. Koessner, Mobil Oil Company Field Research Laboratory, Dallas, Texas.

Discussion Leaders:

Dr. Jeff C. Davis, University of South Florida.
Dr. Charles G. Moreland, North Carolina State University at Raleigh.

Registration Fee: A tuition charge of $100 will be made to non-academic participants and a charge of $50 to academic participants. This will include the cost of a banquet. Participants must meet their own living and travel expenses, with the possible exception that some support for academic participants may be forthcoming from NSF. Rooms for most of the participants, as well as meals, will be available in the Union Building in which the classes will be held. In addition, there are a number of large motels within a mile of the campus.
Dear Dr. Shapiro,

Studies of nuclear spin-lattice relaxation in several molecules containing both hydrogen and fluorine have shown that, at ambient temperatures, the longitudinal relaxation time, T₁, of the fluorine is considerably shorter than that for the hydrogen nuclei. The results have been interpreted in terms of relaxation mechanisms operating on fluorine alone; both anisotropy in the chemical shift and spin-rotation interaction have been proposed as likely contributors. However, the anisotropy contribution to the fluorine of CFHCl₂ has been shown (1) to be very small, and for C₆H₅CF₃ and CHF₃ the relaxation has been satisfactorily described (2) solely with reference to dipole-dipole and spin-rotation contributions.

In an attempt to discover the dominant relaxation mechanisms for ³¹P, a pure liquid sample of P₄O₁₀ was examined at 25 and 15 Mc/s. T₁ was found to be 11.69 ± 0.75 sec. and 11.27 ± 1.5 sec. respectively. Measurements on an oxygen-free sample at ambient temperatures, were made using the saturation recovery technique.

The separation of the intermolecular, intramolecular, anisotropy, and spin-rotation contributions is straightforward in this case. First, the anisotropy contribution can be ignored because of its dependence on the square of the applied field, in contrast to the field invariance of T₁ found experimentally. Second, calculations of the dipolar interactions lead to the following very small values:

\[
\frac{1}{T₁}_{\text{INTRA}} = 9.2 \times 10^{-5} \text{ sec}^{-1}; \quad \frac{1}{T₁}_{\text{INTER}} = 8.1 \times 10^{-4} \text{ sec}^{-1}.
\]

The calculations were made using the well-known formulae (3).
Dr. B.L. Shapiro.

\[(1/T_1)_{\text{INTRA}} = \frac{3}{2} \gamma^2 \hbar^2 \sum_j d_{ij}^{-6} \zeta_c\]

\[(1/T_1)_{\text{INTER}} = \frac{3}{2} \gamma^2 \hbar^2 \pi^2 N \gamma / kT\]

where the inter-phosphorus distance \(d_{ij} = 2.95 \text{ Å}\),

the viscosity \(\eta_{21^\circ \text{C}} = 0.025 \text{ poise}\),

and the reorientational correlation time \(\tau_c = 4 \pi \eta a^3 / 3kT\).

We are therefore, left with spin-rotation as the dominant mechanism for \(^{31}\text{P}\) relaxation in \(\text{P}_4\text{O}_6\). According to Hubbard (4), for spherical molecules, the spin-rotation contribution to \(T_1\) can be expressed as

\[(1/T_1)_{\text{SR}} = 2 I \zeta_{\text{SR}} \eta^2 kT / \hbar\]

where the spin-rotation correlation time \(\zeta_{\text{SR}}\) is given by (4)

\[\zeta_{\text{SR}} = I / 6kT\]

Taking \(T_1 = 11.69 \text{ sec.}\), and the moment of inertia of \(\text{P}_4\text{O}_6\) as \(7.824 \times 10^{-38} \text{ gm.cm}^2\),

the modulus of the spin-rotation coupling constant, \(\zeta\), is \(19.5 \pm 1 \text{ k c/s}\).

Since there is no molecular beam data with which to compare this value,

the following relationship between spin-rotational interaction and nuclear magnetic shielding (5) may be used to calculate the paramagnetic contribution to the chemical shift.

\[\sigma_{\text{PARA}} = e^2 / 3 mc^2 \left[ \frac{1}{r_i} z_i / r_i^2 + \hbar^2 / 3 \zeta \right] I / 4M \mu^2 N \sigma_P J\]

where \(z_i\) and \(r_i\) are the nuclear charge and distance of the \(i\)th nucleus, \(\sigma_P\) is the nuclear \(\sigma\)-factor of \(^{31}\text{P}\) and the factor \(3 \zeta \) I replaces the summation of products of principal moments of inertia, and spin-rotation tensor components.

Taking the magnetic moment of \(^{31}\text{P}\) as \(1.1305 \text{ Bohr magnetons}\)

\[\sigma_{\text{PARA}} = (-346 \pm 7388) \times 10^{-6}\]

where the choice of sign for the second term depends on the sign of \(\zeta\). The negative sign gives \(\sigma_{\text{PARA}} = -7734 \text{ ppm}\), which is of the same order as the value of \(-11,828 \text{ ppm}\) calculated by Letcher and Van Wazer (6) for the phosphorus paramagnetic shift in 85% phosphoric acid.
Dr. B.L. Shapiro.

If these values are correct, the true magnetic moment of $^3\text{P}$ is approximately 1% lower than the currently accepted value used above, which is derived from resonance measurements.

Yours sincerely,

[Signature]

Research Department.


Dear Prof. Shapiro,

We wish to make a comment on the dependence of pseudocontact shifts on correlation times.

McConnel and Robertson [J. Chem. Phys., 29, 1361 (1958)], who have derived the expressions for the pseudocontact shifts, distinguish between two cases: solid and liquid. A system is defined as liquid only when the molecular tumbling is characterized by a correlation time

$$\tau_c < \frac{1}{k (g_H - g_L)}^{-1}.$$ 

Now, for $H_c = 1.4 \times 10^4$ gauss one has the condition $\tau_c < 0.8 \times 10^{-11} |g_H - g_L|^{-1}$ sec, and it is not immediately obvious that for a given complex even in solution, this requirement is fulfilled. Consideration of the correlation time for molecular tumbling should always be made in order to choose the correct expression for the pseudocontact contribution. We should like to point out, however, that in those cases where $\tau = 10^{-11} |g_H - g_L|^{-1}$ sec both the expressions, for solids and liquids, do not hold.

The Fermi-contact and the pseudocontact contributions to the shifts are linear with $1/T$ and should extrapolate to zero at $1/T = 0$, whereas greater slopes and large intercepts are expected for systems with $\tau_c = 10^{-11} |g_H - g_L|^{-1}$ sec. In fact we have observed such phenomena in aqueous solutions of rare-earth ions.

Sincerely yours,

Jack Reuben Daniel Fiat
Subject Index for IITNMRN

Dear Dr. Shapiro,

With the number of issues of IITNMRN now over 100 we, and perhaps others, have found it increasingly difficult to retrieve information. Some time ago Miss P.M. Lutley of our laboratories started to make a subject index on which she has worked in her rare free moments. This index now covers the period July 1965 to June 1966 inclusive, and as you can imagine, it turned out to be a much more formidable task than we anticipated. Apart from a few entries and editorial changes, it is now ready for typing, and we should be able to send it to you in the next couple of months.

I would like to suggest that it may be a good idea to have a mandatory list of index words, including names of chemicals, with each contribution, as well as the now mandatory title. People can then make their own indexes much more quickly and even an "official" subject index becomes a possibility.

In the spirit of the recent exchange of letters, Epexegesis and Son of, I should perhaps entitle this one "Dangling a Carrot". Since, however, there is liable to be a misunderstanding in which I would probably get axed, I thought better of it.

Yours sincerely,

M.A. Weinberger.
Dear Dr. Weinberger:

Thanks for your September 5 letter about a Subject Index for the IIT NMR Newsletter. Your Miss Lutley has, I am sure, accomplished a most Herculean and useful task, although I shudder to think of the size of this one-year's index, and the cost of producing it; in any event, I look forward to receiving it.

Some time ago (would you believe several years?) we prepared an Author Index covering a few year's span. This proved very useful, although again rather large and costly. Perhaps it is time to do this again, and I herewith call for a volunteer to step forward, although I am compelled to warn that it is not a small task (Zero-order calculation: (Say) 30 issues x ca. 25 contributions per issue x ca. 2.74 authors per contribution = a large number of entries to be processed and typed.). I am, however, prepared to be most generous toward anyone submitting such an index (the details of which should probably be ironed out in advance with me for logistic reasons): the reward will be one subscription credit (i.e. + 9 months) to the Newsletter, plus the original copy of the Freeman etching or Lauterbur letter of your choice.

Returning (!) to your letter, I must reject, tentatively at least, your idea of making it mandatory for each contributor to prepare a list of index words for his contribution. This would, in my opinion, raise significantly the energy barrier to contributing for many of our busy participants, and would also add to the space and other logistic problems, etc. Besides, such a step would make the Newsletter more formal and journal-like, which would be Bad. I feel it would be much better for you and Miss Lutley to take this task on as a continuing mission, if you can find your way clear to do so; perhaps you could keep a running index which could be included in the Newsletter every (say) 6 months or so. Suggestions from one and all re this, or other "off-line", major contributions to the production of the Newsletter, would be most welcome. We will be happy to attend to the production and distribution of such things, as long as the money holds out.

With all best regards,

Bernard L. Shapiro
Visiting Scholar (sic)

P.S. I do not understand your last paragraph, although it sounds vaguely improper. I will therefore consult with my learned neighbors Messrs. Ettinger and Freeman, who will, I am sure, be able to explain it to me.
Professor Barry Shapiro  
Department of Chemistry  
Stanford University  
Stanford, California 94305  

Dear Barry,

Long Range Coupling in Heterocyclics

I am sort of reluctant to send in two contributions within two weeks, particularly after a request for our next contribution. However, I am stimulated to do so after reading the recent contribution by Dr. H. Fritz (IIT NMR Newsletter, 107-4) concerning the observed long range coupling between the indicated trans-hydrogens in 1.

\[
\begin{align*}
A = B &= \text{CCl}_3 \\
A &= \text{CCl}_3, B &= \text{H} \\
A &= \text{H}, B &= \text{CCl}_3
\end{align*}
\]

In our recent contribution (IIT NMR Newsletter 100-38) we discussed the NMR spectra of 2-substituted-1,3-oxathiolanes 2. The spectra of these compounds were recorded on our HR-60, and due to field stability problems associated with very slow scans on the HR-60 we were restricted to employing fairly rapid scans. We observed that the signals representing \( H_A \) (pseudoaxial) and \( H_X \) (pseudoequatorial) were slightly broadened. A few months ago we received our A-60-A. Slow scans (1000 sec sweep time, 100 Hz sweep width) of the spectra of these compounds revealed that \( H_A \) and \( H_Y \) were spin-coupled.
J = 0.55 Hz. We have not determined the sign of the coupling constant. The half-height peak width for the resonance lines of H and TMS are 0.45 Hz.

This observation is very similar to that of Dr. Fritz's. Dr. Fritz suggested coupling via five bonds by $\sigma-\pi$ interaction. However, he did not observe this long range coupling with compound 3. This would seem to indicate that the coupling might involve a four-bond interaction through the oxygen atom. It is interesting to note that there is no long range coupling observed through the sulfur atom.

With best regards,

Daniel J. Pasto
Associate Professor of Chemistry

DJP:dw
Dr. Bernard L. Shapiro  
Department of Chemistry  
Stanford University  
Stanford, California 94305

Dear Dr. Shapiro:

For the last year we have been trying to follow the fluorine exchange with pmt of compounds of the type $R_2MF_2$, where $R = CH_3$ or $C_6H_5CH_2$ and $M = As$ or $Sb$. Until this past week we have not been able to get reproducible results for any of the compounds in the various solvents tried; the problem being that the compounds attack glass and are extremely sensitive to $H_2O$. We are now using teflon cells (NMR Specialties) and are getting interesting (and very reproducible) results. Some of our preliminary findings are listed in Table I below. At present we think that the first-order exchange for $(C_6H_5CH_2)_3AsF_2$ in $CCl_4$ and $C_6H_6$ involves an ionization mechanism. We would be interested in hearing from anyone who has a general line-shape equation program which will run on the IBM 360/75.

Table I

Fluorine-Exchange Data$^a$ For 0.10M, 0.15M and 0.20M $(C_6H_5CH_2)_3AsF_2$ in $CCl_4$

<table>
<thead>
<tr>
<th>$t$, °C</th>
<th>$\tau$, sec</th>
<th>$1/\tau$, sec$^{-1}$</th>
<th>$\Delta E_a$, kcal/mole</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>0.0610</td>
<td>16.4</td>
<td>15.8 ± 2</td>
</tr>
<tr>
<td>60</td>
<td>0.0138</td>
<td>72.5</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>0.00613</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>0.00428</td>
<td>233</td>
<td></td>
</tr>
</tbody>
</table>

$\Delta E_a$, kcal/mole

$C_6H_6$

<table>
<thead>
<tr>
<th>$t$, °C</th>
<th>$\tau$, sec</th>
<th>$1/\tau$, sec$^{-1}$</th>
</tr>
</thead>
<tbody>
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<td>48</td>
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<td>85.0</td>
</tr>
<tr>
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<td>0.00613</td>
<td>163</td>
</tr>
<tr>
<td>70</td>
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<td>262</td>
</tr>
<tr>
<td>80</td>
<td>0.00304</td>
<td>330</td>
</tr>
</tbody>
</table>

$\Delta E_a$, kcal/mole

$C_6H_6$

$\Delta E_a$, kcal/mole

$C_6H_6$

$\Delta E_a$, kcal/mole

$C_6H_6$

$\Delta E_a$, kcal/mole

$C_6H_6$

$\Delta E_a$, kcal/mole

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$C_6H_6$

$\Delta E_a$, kcal/mole

$C_6H_6$

$\Delta E_a$, kcal/mole

$C_6H_6$
One of us (CGM) spent June and July at the University of Florida working with Professor Wallace S. Brey on F-n.m.r. and computer analysis of second-order spectra. We were able to get LA03 as revised by Roger Reaville of Procter and Gamble to run on the IBM 360 at Florida and NCSU.

We have recently purchased a second spectrometer, the DA-60EL, which we hope to have in operation as soon as Varian sends an engineer.

Sincerely yours,

C. G. Moreland
Assistant Professor

L. J. Gerenser
Associate Professor
September 5, 1967

Associate Professor Bernard L. Shapiro
Department of Chemistry
Stanford University
Stanford, California 94305

Dear Dr. Shapiro:

I would like to notify IIT Newsletter readers of an opening in our laboratory for an NMR spectroscopist with a good organic background to be in charge of our NMR group. Duties will at least entail: (1) interpretation of the more difficult spectra in $^{31}$P, $^1$H, $^{19}$F and $^{13}$C; (2) setting up complex mixture analyses, (3) utilizing computer analysis to give more detailed structural data, (4) continuing a training program for other laboratory research chemists in NMR and (5) updating our instrument further to give better performance with the less sensitive nuclei.

We have an HA100 and routinely run hydrogen phosphorus and fluorine. Carbon is run on special request. Technicians are available to run the instrument, two electronics personnel repair the instrument and a chemist to do routine analysis.

If anyone is interested please contact Mr. A. V. Thorpe in our personnel department.

Yours truly,

James G. Colson
"CRACKING PARAMAGNETIC SHIFT PEANUTS WITH A FIELD-FREQUENCY CONTROL STEAM ROLLER ON THE HA-100"

Dear Barry:

Chien Ho, Don Davis and I have been interested for some time in paramagnetic Hemin derivatives. The proton spectra of these compounds show broad lines (of the order 100 Hz half-width) shifted ca. 30 to 70 ppm downfield from TMS. The 60 MHz spectra are, in several cases, complicated by overlapping lines; we therefore decided to use the HA-100 to spread things out and, while we were about it, to modify (temporarily) the HA-100 for field-frequency control operation with the required large sweep ranges and offsets.

A rough description of our set-up follows. The frequency sweep channel of the HA-100 "Lock-Box" is used in the "Field Sweep" mode with the following modifications: the sweep frequency is provided by a General Radio 1161-C audio frequency synthesizer, the output of which is connected to the "Sweep Frequency Out" connection at the rear of the Lock Box, after the "Oscillator Amplifier" and "Sweep Oscillator Network" cards are removed from the Lock Box. The GR frequency synthesizer is swept by a triangular voltage sweep ramp built by Dennis Wisnosky here at Mellon. The detection channel uses a Princeton Applied Research JB-5 audio phase sensitive detector in an "Internal Reference" mode; the reference frequency from the JB-5 is used, without amplification, to frequency modulate the V-4311 r.f. unit. A Mosely XY-recorder driven by the voltage sweep ramp, is used, rather than the HA-100 recorder.

With a two percent (V/V) DMSO line used as a lock signal in the field sweep mode one can sweep (and stay locked) over a range of 1 kHz to 9 kHz in a sweep time of 60 seconds, with no adjustments of the rf phase control required. Sufficient modulation is provided by the PAR for the large rf power needed to detect the lines in these paramagnetic substances, even at modulation frequencies in the 10 to 15 kHz range.

In the interests of space (and in order to meet the deadline for this month's contribution) I've omitted block diagrams of the experimental set-up and copies of spectra. With regard to the former, either Dennis Wisnosky (who was largely responsible for getting the modifications set-up) or I will be happy to supply more information. With regard to the latter, we're awaiting the results of variable temperature experiments before completing spectral assignments, but we'll be glad to correspond with those interested in our results so far.

Sincerely yours,

Robert J. Kurland
Carnegie-Mellon University
TITLES FOR MELLON INSTITUTE BIBLIOGRAPHY (IITMRRN)

"Self association in aromatic thiols"
C.R.Kanekar, G.Govil, C.L.Khetrapal, and M.M.Dhingra
Proc. Indian Acad. Sci. 65A, 265 (1967)

"Solvent effects on proton chemical shifts in the thiophenes"
C.R.Kanekar, G.Govil, C.L.Khetrapal and M.M.Dhingra
Proc. Indian Acad. Sci. 65A, 195 (1967)

Aromaticities of monosubstituted benzenes and thiophenes"
M.M.Dhingra, G.Govil, C.R.Kanekar, and C.L.Khetrapal

G. Govil
21. 3. 67.
CARNEGIE-MELLON UNIVERSITY
BIBLIOGRAPHY

"The Methylation of Nicotine with Methyl-lithium"
F. Haglid

"Bacterial Carotenoids. XXI. Isolation and Synthesis of 3,4,3,4,6-Tetrahydro-spirilloxanthin"
A. J. Aasen and S. L. Jensen
Acta Chem. Scand. 21, 371 (1967)

"Saccharinic Acids from D-Xylose and D-Fructose"
A. Ishizu, B. Lindberg and O. Theander
Acta Chem. Scand. 21, 424 (1967)

"Photochemical Coupling between Tin Tetrabromide and Simple Aliphatic Bromine Compounds"
K. Taugbol, E. Augdahl and A. N. Sara
Acta Chem. Scand. 21, 505 (1967)

"The Reaction Between Acetylacetone and £-Benzoquinone. IV. Structure of Tetracetyl-£-xyloquinone"
E. Bernatek, M. Johnsgard and T. Stensrud
Acta Chem. Scand. 21, 574 (1967)

"Some Comments on a Reported Quinuclidine Synthesis"
F. Haglid
Acta Chem. Scand. 21, 579 (1967)

"Synthesis of Tricyclic Homologues of 1,6- and 2,7-Naphthyridine"
P. Haglid
Acta Chem. Scand. 21, 580 (1967)

"Some Methods for Stereoselective or Stereoselective Preparation of cyanthryl-2-Methyl-3-propionoquinic Acid"
B. Abermark and N.-G. Johansson
Acta Chem. Scand. 21, 583 (1967)

"Cupaborneol, the Major Sesquiterpene Alcohol in Pinus sylvestris Wood and Sulphate Turpentine"
M. Kolbe and L. Westfelt

"Spectroscopic Studies on Enols. Part 8. Preferential Ring Enolisation of 2-Formylcyclopent-1,3-dione"
S. Forsen, F. Merenyi and M. Nilsson
Acta Chem. Scand. 21, 620 (1967)

"Studies on Methylined 1,2,3-Triazoles. III"
M. Regstrup and C. Pedersen
Acta Chem. Scand. 21, 633 (1967)

"Unsaturated y-Thiolactones. V. On the Rearrangement of Some 5-Alkyl-substituted Thiolene-2-ones"
A. B. Hoiland
Acta Chem. Scand. 21, 673 (1967)

"The Acid-catalysed Reaction between Chloroaceton or 1,3-Dichloroacetone and Hydrogen Sulphide"
C. Rappe and R. Gustafsson
Acta Chem. Scand. 21, 705 (1967)

"A Convenient Synthesis of Thieno[2,3-b]thiophene"
S. Gronowitz and B. Persson
Acta Chem. Scand. 21, 812 (1967)

"The Oleoresin of Norwegian Spruce, Picea abies (L.) Karst. - Isolation of (-)-Geranylinalool"
B. Kimland and T. Norin
Acta Chem. Scand. 21, 825 (1967)

"Gas Chromatographic Determination of 4-Benzothienyl 2-Methylcarbene"
A. J. Zettlein, D. N. Gaskell, and C. A. Lucyshen
Anal. Chem. 39, 721 (1967)

"Noise Discrimination by Signal Inversion in Nuclear Magnetic Resonance Spectroscopy"
A. J. Van Geet and L. D. Wechsler
Anal. Chem. 39, 850 (1967)

"1,3-Cycloadditions of Mesomeric Oxaazoles to Carbonyl Compounds"
R. Huisgen and E. Funke

"Stable 1,4-Dipoles from Ketene Acetals and Carbon Disulphide and their Use for Synthesis of Heterocycles"
R. Gompper and W. Elser

"The Norcaradiene Problem"
G. Maier

"Recent Chemistry of Bullvalene"
G. Schroder and J. F. M. Oth

"Coordination Compounds with Stationary and Oscillating Acceptors"
H. Schmale and W. Wolfsberger

"Low-Melting Nematic Phases for Determination of NMR Spectra of Orientated Molecules"
H. Spiesecke and J. Bellion-Jourdan

"1,3-Bis(dimethylamino)pentalen"e"
K. Hafner, K. F. Bangert, and V. Orfanos
"Studies on Tacticity of Polyacrylonitrile. I. High Resolution Nuclear Magnetic Resonance Spectra of Polyacrylonitrile"
R. Yamadera and M. Murano

"NMR Spectra of Stereosomers of 2,4,6-Tricyanoheptane as Model Compounds of Polyacrylonitrile"
M. Murano, and R. Yamadera

"Polyaddition Reactions of N,N'-Bis-1,2-Alkylenamides with Dicarboxylic Acids!"
G. J. Del Franco, M. Guagliardo, P. Loewrigkeit, and N. Georgalas

"Configuration of Isoprene Structure in Butyl Rubber by Time-Avg-reasing High Resolution Nuclear Magnetic Resonance"
H. Yu Chen and J. E. Field

"Investigations of Poly-S-Lactic Acid Structure in Solution*"
M. Goodman and M. D'Alaghi

"Uber die anionische Polymerisation G,G-ungea~ittigter Aldehyde. 33. Mitt. Uber Polymere Acroleine"
R. C. Schulz, G. Wegner und V. Korn

"A Variable Frequency Transmission Line Nuclear Magnetic Resonance Spectrometer with Servo-correction of Background"
R. G. Scarrlock, D. H. Utton, and T. H. Wilmshurst

"The Orientational Freedom of Molecules in Crystals. I. Joint Interpretation of Thermal and N.M.R. Data in an 'All or Nothing' Correlation of Orientation Theory"
I. Darmon and G. Soret
Mol. Cryst. 3, 301 (1967)

"Effect of Relaxation on the Nuclear Double Resonance Spectra of Weakly Coupled Spin Systems; Proton Double Resonance in Ethyl Fluoride"
B. D. Nageswara Rao and L. Lessinger
Mol. Phys. 12, 221 (1967)

"NMR Spectra of workout
"13C Spectra of Proton and Fluorine Resonance Spectra Substituted Fluorobenzenes"
S. Mohanty and P. Venkateswarlu
Mol. Phys. 12, 277 (1967)

"Effect of Electrolytes on Moisture Determination by Nuclear Magnetic Resonance"
L. E. Saraf, and P. Pitt
Nature 214, 1219 (1967)

"Nuclear Magnetic Resonance in Liquid Sodium Alloys"
S. X. Kellington and J. M. Titman
Phil. Mag. 13, 1045 (1967)

"Deuterium and 37Cl Spin Lattice Relaxation in DCl and ECl"
J. G. Fowles and M. Rhodes
Anomalous Behaviour of the Knight Shift in SmAl₂
K. J. L. Buschow and A. M. van der Pauw

"Nuclear Magnetic Aromatic Resonance in KTaO₃"
R. W. Mebs, L. H. Bennett, and J. R. Leibowitz

"Nuclear Magnetic Relaxation in the Transition Metals: Scandium, Yttrium, Lanthanum, and Yttrium Dihydride"
A. Narath and T. Fromhold, Jr.

"Properties of the NMR Nuclear-Magnetic-Resonance Modes in Al₂O₃"
L. S. Walsh
Phys. Rev. 156, 370 (1967)

"Nuclear Magnetic Resonance and Magnetic Susceptibilities of Y-Ba Alloys"
D. J. Lenn, J. J. Ureghis, and D. O. Van Oostenburg
Phys. Rev. 156, 735 (1967)

"Density-Matrix Derivation of the Spin-Diffusion Equation"
L. J. Lowe and B. Gede
Phys. Rev. 156, 219 (1967)

"Nuclear Magnetic Resonance in Single-Crystal Terbium Metal at 100 GHz"
J. L. Stanford and R. C. Young
Phys. Rev. 157, 245 (1967)

"Magnetic Resonance of N₂⁺ in Pb₃, PbSe, and PbTe"
J. B. Pifer
Phys. Rev. 157, 272 (1967)

"Generalized Transformation to a Rotating Coordinate System in Quantum Mechanics"
H. C. Pradadda

"Magnetic Resonance Studies of Ferroelectric Methylammonium Alum"
D. E. O'Reilly and T. Tani
Phys. Rev. 157, 517 (1967)

"Nuclear-Magnetic-Resonance Free Induction Decay in a Two-Spin System"
M. Lee, D. Tse, W. I. Goldberg, and I. J. Lowe
Phys. Rev. 158, 246 (1967)

E. D. Jones
Phys. Rev. 158, 295 (1967)

"Spin-Lattice and Cross Relaxation of ⁵⁴Mn Nuclei in Dilute Paramagnetic Crystals"
J. Lubbers and W. J. Huiskamp
Physica 34, 166 (1967)

"Nuclear Orientation by Means of Rotational Cooling and Thermal Mixing Between Nuclear and Electronic Spin Systems"
J. Lubbers and W. J. Huiskamp
Physica 34, 193 (1967)

"Spin-Lattice Relaxation of ⁵⁴Mn Nuclei in Concentrated Paramagnetic Crystals"
J. Lubbers and W. J. Huiskamp
Physica 34, 212 (1967)

"Studies on Plant Growth Regulators—XX. Structure/Activity Relationship of α-Alkyl-Hydro-1-Naphtholic Acids and Related Compounds"
T. Fujita, K. Kusama, T. Mitsui, and M. Katsumi
Photochem. 5, 889 (1967)

"Rhodanese Tweak T min"
J. W. R. Morgan and R. J. Oster
Photochem. 5, 1007 (1967)

"The Conformation of Non-Aromatic Ring Compounds. Part 35. Triethylene Sulphite and Related Compounds"
H. F. Van Woerden and E. Havinga

"The Chemistry of Cyclopropaones. Part IV. Addition of mono- and di-methylene"n
W. J. M. Van Tilborg, E. Schaarsma, H. Steinberg, and Th. J. De Boer

"Chemistry of Acetylenic Ethers. Part II. Synthesis of α-hydroxy-alkynes, substituted at the α-carbon atom"
A. Schaar, L. Brandma, and J. F. Arens
Rec. Trav. Chim. 86, 393 (1967)
The Production of the Species 198H (CO)₃(ligand) from Dimegnetane Decacarbonyl and Trispiphosphorine or Triphenyl Phosphite
R. Ugo, and F. Bonati
J. Organometal. Chem. 8, 189 (1967)

Phosphinomethylthiullium Compounds. IV. An Improved Method of Preparation and Some Synthetic Applications
D. J. Paterson
J. Organometal. Chem. 8, 199 (1967)

Mono- and Diaklyltitanocene Dichlorides
M. Y. Sullivan and W. F. Little
J. Organometal. Chem. 8, 277 (1967)

Organometallic Chemistry of the Transition Metals XXI. Some Ti-Phenanthrolylcyclopentadienyl Derivatives of Various Transition Metals
R. B. King and M. B. Bisnett
J. Organometal. Chem. 8, 287 (1967)

Perfluoropropyl Derivatives of the Elements. XI. Metal Carboxyl Derivatives of Tetrafluorobenzobicyclo[2.2.2]Octatetraene
A. J. Tomlinson and A. O. Massay
J. Organometal. Chem. 8, 321 (1967)

Triacarbonylnickel Complexes of Tetraarsenic and Tetraphosphorus Hexamethylimidides
J. G. Riess and J. R. van Wazer
J. Organometal. Chem. 8, 347 (1967)

Organocadmium Reagents. III. Displacement of Acyloxy at Saturated Carbon
P. R. Jones, G. C. Jarboe, and B. Wadeau
J. Organometal. Chem. 8, 361 (1967)

Reactions of Phenyl[bromodichloromethyl]mercury with Alkenylnitrogen Compounds
D. Seyferth and B. Prokai
J. Organometal. Chem. 8, 366 (1967)

NMR and IR Studies of Dihalyltin Halide Hydrides
J. Organometal. Chem. 8, 377 (1967)

Some Bis-Amine Complexes of Boronium Ions With Bulky Substituents of Boron
J. E. Douglas, G. R. Roehrig and On-Hou Ma
J. Organometal. Chem. 8, 421 (1967)

Organoinidin Chemistry. I. A Convenient Preparation of Dimethylthiium(III) Derivatives
H. C. Clark and A. L. Pickard
J. Organometal. Chem. 8, 427 (1967)

Some Dichloro Compounds Derived From Octaphenylcyclotetrasilanes and Decaphenylcyclopentasilane
H. Gilman and D. R. Chapman
J. Organometal. Chem. 8, 451 (1967)

Mössbauer Studies of Various Transition Metals
H. C. Clark and A. L. Pickard
J. Organometal. Chem. 8, 459 (1967)

The Reaction of α-Allylpentacarbonylmanganese With Some Strong Proton Acids
M. L. H. Green, A. G. Massey, J. T. Norwly-Hughes, and (the late) F. L. I. Nagy
J. Organometal. Chem. 8, 479 (1967)

Infrared and Nuclear Magnetic Resonance Spectra of Aldy- and Aclmethylpentacarbonyls
E. Noack, U. Schafer and P. Calderazzo
J. Organometal. Chem. 8, 517 (1967)

A New α-Bonded Aryl-Cobalt(III) Complex
A. C. Copc and R. H. Gourley
J. Organometal. Chem. 8, 527 (1967)

Über 6,6'-Diphenylfulven-1-C Komplexe des Kobalts, Rhodiums und Iridiums
E. O. Fischer and B. J. Wehmann
J. Organometal. Chem. 8, 533 (1967)

Investigations on Organozinc Compounds VI. NMR Study of Unsolvated Organozinc Halides
J. Boersma and J. G. Holtes
J. Organometal. Chem. 8, 551 (1967)

Carbon-13 Chemical Shifts of the Carbonyl Group. V. Observation of a Deuterium Isotope Effect Using Carbon-13 Field-Fluency Lock
G. E. Maciel, P. D. Ellis, and D. C. Hofer
J. Phys. Chem. 71, 2160 (1967)

Nuclear Magnetic Resonance Spectra of Alkylethenes and Alkylhexanethes
R. H. Barker, S. L. Vail, and G. J. Boudreaux
J. Phys. Chem. 71, 2228 (1967)

Nuclear Magnetic Resonance Fluorine-Fluorine Coupling Constants in Fluorotitanate Complexes
D. S. Dyer and R. O. Bagedale
J. Phys. Chem. 71, 2309 (1967)

Barriers to Internal Rotation in Thioamides. Experimental Results and Molecular Orbital Calculations
J. Sandström
J. Phys. Chem. 71, 2318 (1967)

Comments on the Nuclear Magnetic Resonance Spectrum of Dithyldiprydylindinichl
G. Castellano, and H. Glätsher
J. Phys. Chem. 71, 2368 (1967)

The Nuclear Magnetic Resonance Interpretation of Dithyldiprydylindinichloride Complexes of Substituted Dipyridyl
F. Saito, M. Araki, T. Uchida, and A. Hisino
J.Phys. Chem. 71, 2370 (1967)

N.M.R. Investigation of the Atomic and Electronic Structure of Vanadium and Mithbin Carbides
C. Froidevaux and D. Rossier

Influence de la diffusion des électrons de conduction sur la résonance nucléaire dans certains alliages décarburoés
J. Seiden
J. Physique 27, 691 (1966)

Studies of organometallics structures of Vanadium and Mithbin Carbides
C. Froidevaux and D. Rossier

Polarisation Dynamique Nucléaire par Cycles de Mélange Théorique
M. Goldman
J. Physique 28, 211 (1967)
"Chemical Shifts in Donor Substituted Polycyclic Aromatics"  
A. Zuoig, J. K. Lancaster and M. T. Neglia  
Tetrahedron 23, 2577 (1967)

"Photosensitized Oxidation of Alkyl-substituted Furan"  
C. S. Poote, M. T. Wuesthoff, S. Wekler, Z. G. Burstain,  
R. Denne, G. O. Schenck and K. H. Schulte-Kleve  
Tetrahedron 23, 2583 (1967)

"Structure and Stereochemistry of the Ketoacids Derived  
from Methoxynorphan foropectide"  
C. S. Poote, M. T. Wuesthoff and I. G. Burstain  
Tetrahedron 23, 2591 (1967)

"The Isolation and Identification of the C17 Saturated  
Isoprenoid Hydrocarbon 2,6,10-Trimethyltetradecane  
from a Devonian Shale. The Role of Squalane as a  
Possible Precursor"  
E. B. McCarthy and H. M. Calvin  
Tetrahedron 23, 2601 (1967)

"A New 1,3-Dipolar Cycloaddition Reaction. Synthesis of  
some Isoxazolidine Derivatives"  
M. Ochiai, M. Obayashi and K. Morita  
Tetrahedron 23, 2611 (1967)

"The Structures of Fibraurin and A Minor Product from  
Fibraures Chloroform"  
T. Nishiwaki, A. K. Kiang, T. Hori, A. K. Kiang,  
and N. M. Waldron  
Tetrahedron 23, 2621 (1967)

"5-Halogenopyrimidines—V. Solvent Effects on the NMR  
Spectra of Pyrimidines and Consideration on the  
Association of 4-Hydroxypyrimidines"  
T. Nishiwaki, A. K. Kiang, and N. M. Waldron  
Tetrahedron 23, 2651 (1967)

"The Reaction of the Isoxazolinopyridinium Cation with  
Amines"  
R. K. Kiserhal, A. B. Katrizyk and E. Lont  
Tetrahedron 23, 2775 (1967)

"The Isolation of New Oxetone Derivatives from Hop Oil"  
J. B. Lee and T. J. Nolan  
Tetrahedron 23, 2789 (1967)

"The Reaction of Triarylporphines With Phenylacetylene in  
the Presence of Water"  
D. W. Allen and J. C. Tebby  
Tetrahedron 23, 2795 (1967)

"The Oxidation of Some Pyrogallol and Purpuragallin  
Derivatives"  
A. Critchlow, F. Haslam, R. D. Haworth, F. B. Tinker  
and H. M. Waldron  
Tetrahedron 23, 2829 (1967)

"Derivatives of 5-Deoxy-5-Seleno-D-Xylose"  
S. W. Breuer, T. Bernath and D. Ben-Ishai  
Tetrahedron 23, 2949 (1967)

"The Synthesis of Methyl 5-0-Benzyol-2,3-Dideoxy-2,3-  
Dideoxy-5-Hexonate derivatives"  
J. K. Crandall and R. J. Watkins  
Tetrahedron Letters 1717 (1967)

"1,5-Hydrogen Migrations in Medium-ring 3,4-Epoxycyclo-  
akanes"  
J. K. Crandall and R. J. Watkins  
Tetrahedron Letters 1717 (1967)

"Cyclopropylcarbinyl Rearrangements in the Thujopsene  
Series"  
W. G. Dauben and L. K. Friedrich  
Tetrahedron Letters 1735 (1967)

"The Cyclization Phase of the Fischer Indole Synthesis.  
The Structure and Significance of Fleming’s Intermediates"  
R. J. Owellen, J. A. Fitzgerald, B. M. Fitzgerald, D. A.  
Welsh, D. M. Walker, and F. L. Southwick  
Tetrahedron Letters 1741 (1967)

"Synthesis of 1,3,4,6,7,9-Hexamethylenalene"  
P. Canonne, and L. C. Leitch  
Tetrahedron Letters 1757 (1967)

"Formation of Cyclopropane and Dihydrobenzosuran  
Derivatives Through Oxidative Coupling of Methylene-  
bis—1,3-Cyclohexanedicarboxyls"  
O. K. Hartson and C. A. Wachtmeister  
Tetrahedron Letters 1853 (1967)

"Furan Synthesis by 1,4 Addition of Carboethoxycarbene  
to 1-Methylenemethane Ketone"  
K. M. Storm and I. A. Spencer  
Tetrahedron Letters 1865 (1967)

"Gyromitrin, das Gift der Fruehjahrsfrohre, Gyromitra  
(Helvella) Esculenta Fr."  
P. H. List, P. List, and A. Cover  
Tetrahedron Letters 1893 (1967)

"The Structures of 3-Halo-2-pyrone and 2-Halo-2-pyrone  
and the Synthesis of a Mannosyl Nucleoside"  
R. W. Allen and J. C. Tebby  
Tetrahedron Letters 1945 (1967)

"The Isolation of New Oxetone Derivatives from Hop Oil"  
J. B. Lee and T. J. Nolan  
Tetrahedron 23, 2789 (1967)

"Formation of Cyclopropane and Dihydrobenzosuran  
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Tetrahedron Letters 1757 (1967)

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Tetrahedron Letters 1865 (1967)

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Tetrahedron Letters 1945 (1967)

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J. B. Lee and T. J. Nolan  
Tetrahedron 23, 2789 (1967)

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Tetrahedron Letters 1853 (1967)

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R. J. Owellen, J. A. Fitzgerald, B. M. Fitzgerald, D. A.  
Welsh, D. M. Walker, and F. L. Southwick  
Tetrahedron Letters 1741 (1967)

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Tetrahedron Letters 1757 (1967)

"Formation of Cyclopropane and Dihydrobenzosuran  
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Tetrahedron Letters 1853 (1967)

"Furan Synthesis by 1,4 Addition of Carboethoxycarbene  
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K. M. Storm and I. A. Spencer  
Tetrahedron Letters 1865 (1967)

"Gyromitrin, das Gift der Fruehjahrsfrohre, Gyromitra  
(Helvella) Esculenta Fr."  
P. H. List, P. List, and A. Cover  
Tetrahedron Letters 1893 (1967)

"The Structures of 3-Halo-2-pyrone and 2-Halo-2-pyrone  
and the Synthesis of a Mannosyl Nucleoside"  
R. W. Allen and J. C. Tebby  
Tetrahedron Letters 1945 (1967)

"The Isolation of New Oxetone Derivatives from Hop Oil"  
J. B. Lee and T. J. Nolan  
Tetrahedron 23, 2789 (1967)
"Carbon Disulphide, Carboxyl Sulphide, and Alkyl and Aryl Isothiocyanates and Perfluorothioacetate Complexes of Nickel, Palladium, Platinum, Rhodium, and Iridium"  
M. C. Baird and G. Wilkinson  

"Ligand Displacement Reactions. Part I. Kinetics of the Reaction between Trimethyl Phosphite and Some Tricarbonyl(arene)-molybdenum Complexes"  
A. Picock, J. D. Smith and B. W. Taylor  

"Cadmium Derivatives of Decaborane"  
N. N. Greenwood and N. F. Travers  

"Interaction of Tm(II) Halides with Compounds having Mercury-Metal Bonds"  
F. Bonati, S. Gennini, and R. Ugo  

"Physical Properties and Structure of Diethylaminodifluoroborane"  
N. N. Greenwood and J. Walker  

"Addition of Amine-Boranes to Isocyanates to Form Urea-Boranes Complexes"  
R. H. Cragg and N. N. Greenwood  

"The Interaction of Perfluorobutadiene with Iron and Cobalt Carbenes"  
R. L. Hunt, D. N. Roundhill and G. Wilkinson  

"Effects of p-Electron Densities and Solvent on Proton Resonances of Alkyl-substituted Pyridines and Benzaldehydes"  
R. J. Chuck and E. W. Randall  

"Aromatic Substitution. Part XVI. Reactivity of 3-Isopropyl- and 3-Cyclohexyl- pyridine and of Nicotine towards Phenyllithium"  
E. A. Abramovitch and G. A. Poulton  

"Nuclear Magnetic Resonance Spectra of the Dimers of Hexafluoro- and 2,3,3,4,5-Pentafluoro-cyclopentadiene; Long-range 19F-19F Couplings"  
R. Fields, M. Green and A. Jones  

"The Thermal Decomposition of trifluoroacetic Acid"  
F. G. Blake and H. Pritchard  

S. T. McDowell and C. J. M. Stirling  

"The 19F Nuclear Magnetic Resonance Spectra of para-Bonded Iomers of the Diethyltetrafluorobenzenes"  
L. Cavalli  

"N.m.r. Studies of Rate Processes and Conformations. Part VI. Ring Inversion in Hexahydro-1,3,5-triazines"  
J. M. Lehnh, F. G. Riddell, B. J. Price, and I. O. Shepherd  

"Equilibrium Constants of Charge-transfer Complexes determined from 19F Nuclear Magnetic Resonance Absorption Measurements"  
H. M. D. Brown, R. Foster and C. A. Frye  

"The Ultraviolet Spectra of the 5-Methoxy-3,3-dimethyl- and -1,3,3-trimethyl-3-indolium Cations"  
M. Ahmed and B. Robinson  

"A Autoxidation of N-Alkyl-amides. Part II. N-Alkyl-amide Hydroperoxides and Di-N-alkyl-amide Peroxides"  
B. F. Sagar  

"Solvent Effects in Nuclear Magnetic Resonance Spectroscopy. Part X. Solvent Shifts induced by Benzene in organometallic and meta-substituted Methylenecyclohexanes"  
J. H. Bowie, J. Ronayne, and D. H. Williams  

"Solvent Effects in Nuclear Magnetic Resonance Spectroscopy. Part XI. The Mechanism of Solvent Shifts of Proton Resonances induced by Benzene"  
J. Ronayne and D. H. Williams  

"The Proton Magnetic Resonance Spectra of Some Diosgenyl, Triosogenyl, and Tetraosogenyl Steroids"  
G. B. Bardin and T. J. Barcrom  

"Extracts from Guttiereae. Part V. Seriobaltic Acid, a New Xanthone from Calophyllum acerbitifolium"  
Henderson and Wyatt-Smith  
B. Jackson, R. D. Lockley, and F. Scheinmann  

"Studies Relating to Phthaliacrol, Part VII. Phthiodiolene I"  
D. K. M. Adinikin and N. Polgar  

"The Oxidation of Thiacarbones with Lead Tetra-acetate and with Peroxides"  
T. J. Aisley, A. K. N. Anasumnan and L. M. Owen  

"Alkaloids of Kopsia Species. Part IX. The Constitution of Fruticosine and Fruticosamine"  
A. H. Bettersby, J. C. Byrne, H. Gregory and S. P. Popple  

"West African Timbers. Part XX. The Structure of Turrennathin, and Oxygenated Tetracyclic Terpenes Macracestanes"  

"A Simple Preparation of p-Pyrones"  
R. A. Mullock and M. Reschitzky  

"Cyclisation of 2-Methylbut-2-yn-2-ol. Part I. Cyclisation to Aromatic Cyclopropanes"  
P. Chini, A. Santambrogio, and M. Pallecino  

"Cyclisation of 2-Methylbut-2-yn-2-ol. Part II. Cyclisation to Cyclooctatetraene Derivatives"  
P. Chini, A. Santambrogio, and M. Pallecino  

"Nitration of 2,3-Dimethoxyethanethiol"  
C. W. J. Chang, R. E. Moore, and P. J. Schenez  
"The Syntheses and Properties of Trichlorophosphazene-
chloromethane and Tri(chloromethyl)amine"
J. Moeller and A. E. Westlake

"NMR, Electronic, I.R. and K-Absorption Edge Spectra
of Tris-(isonitrosoacetylacetonato) Cobalt(III)"
E. J. Patel and B. C. Halter

"Carbonion Polymerization of Norbornene and Its
Derivatives"
J. P. Kennedy and C. S. Mahovski

"A Precise Determination of the Proton Coupling
Parameters in Benzene"
J. M. Read, Jr., R. E. Mayo, and J. H. Goldstein
J. Magn. Spectr. 22, 419 (1967)

"Comparison of Kinetic Results Obtained by NMR Line
Shape and Equilibration Methods"
A. Mannschreck, A. Mattheus, and H. Rissmann

"Magnetic Non-Equivalence in Some Derivatives of Tri-k
coordinate Phosphorus"
D. G. Rowell
J. Mol. Spectr. 23, 32 (1967)

"NMR Study of Amino Acids and Their Derivatives, Part
IV. Structure of Serine in Aqueous Solutions"
H. Ogura, Y. Arata, and S. Fujiwara
J. Mol. Spectr. 22, 76 (1967)

"Oxygen-17-Fluorine-19 Spin-Spin Coupling in Acetyl
Fluoride"
J. Reuben and S. Brownstein
J. Mol. Spectr. 23, 96 (1967)

"Phosphorus-Phosphorus Coupling Constants in Tri-
phosphonitriles"
E. G. Finer
J. Mol. Spectr. 22, 104 (1967)

"The Relative Signs of the Long Range Spin-Spin Coupling
Constants in Formic Acid Esters"
E. Hayamizu and O. Yamamoto
J. Mol. Spectr. 23, 121 (1967)

"NMR Studies of N-Nitrosamines. Part II. Saturated
Cyclic Mononitrosamines. The Diamagnetic Anisotropy
of the N-N=O Group"
R. K. Harris and R. A. Speng
J. Mol. Spectr. 29, 158 (1967)

"The Proton Magnetic Resonance Spectra of the
Monohalobenzenes"
J. M. Read, Jr., and J. H. Goldstein
J. Mol. Spectr. 23, 179 (1967)

"Comments on the Ring Inversion of Cyclohexane Studied
by NMR"
B. K. Harris, and N. Sheppard
J. Mol. Spectr. 23, 231 (1967)

"Photoalytic Alkylaion of Aromatic Hydrocarbons Using
Alkylzirconium Compounds"
H. J. S. Winkler, R. Bollinger, and H. Winkler
J. Org. Chem. 32, 1700 (1967)

"Quaternary Benzylenium Ion Rearrangements with
Organolithium Compounds. III. Dimethylbenzylenium
Chloride Reaction with p-Butyllithium"
A. R. Lepley and A. G. Giannini
J. Org. Chem. 32, 1706 (1967)

"Preparation and Reactions of Some Alkylthiomethylmethylthium
Compounds"
D. J. Peterson
J. Org. Chem. 32, 1717 (1967)

"Organophosphorus Chemistry. IV. The Reactions of Trialkyl
Phosphites with p-Halo Ketones"
I. J. Borowitz, M. Anschel, and S. Firstenberg

"Organic Sulfur Compounds. XIX. Free-Radical Addition
of Dialkylphosphoronic Acids to Unsaturated Hydro-
carbons"
W. J. Muller and A. A. Oswald
J. Org. Chem. 32, 1730 (1967)

"Arylboron Compounds. III. The 3-Phenyl-2-norbornanols
and Derivatives. Preparation and Properties"
D. C. Keilhauer, I. E. Dye, J. E. Mallory, and E. S. Trent
J. Org. Chem. 32, 1734 (1967)

"Ferrocenylmethyl Derivatives. VII. Stereochemistry of
Bridgehead Alkylation"
H. G. House and C. J. Blankley

"The Behavior of 2-Acetamido-2-deoxy-D-mannose with Isopropenyl
Acetate in the Presence of .e.-Toluenesulfonic Acid. I.
Isolation and Identification of Derivatives of 2-Amino-D-
gluca(l-2-Amino-1,2-deoxy-D-galabino-hex-1-enopyranose)"
N. Pravdic and H. G. Fletcher, Jr.
J. Org. Chem. 32, 1800 (1967)

"The Behavior of 2-Acetamido-2-deoxy-D-mannose with Isopropenyl
Acetate in the Presence of p-Toluenesulfonic Acid. II. Evidence Bearing on the Mechanism of the
Formation of 3,4,6-Tri-O-acetyl-2-(8-acetylacectamido), etc.
N. Pravdic and H. G. Fletcher, Jr.
J. Org. Chem. 32, 1811 (1967)

"The Formation of Acetylated Oxazolines through the Action of Zinc Chloride and Acetic Anhydride on 3-Acetamino-2-
deoxyaldoses"
N. Pravdic, T. D. Inch, and H. G. Fletcher, Jr.
J. Org. Chem. 32, 1815 (1967)
The Products and Stereochemistry of Reactions of Dinitrogen.  

Solvolytic Stabilization of 6-Benzylidene-1,2,3-triafulvene and Intermediacy of a 5-Methylenebicyclo[2.1.0]pentane Derivative.  

Epoxyamines, A New Functional Group in Organic Chemistry.  
C. L. Stevens, and P. M. Filliti  

The Preparation and Properties of 13, 14-Diastretricyclo[5.4.1.1^2,8]tetradeca-3,5,9,11-tetraene and its Derivatives.  
A. L. Johnson and H. E. Simmons  

H. Tanida, K. Tori, and K. Kitahonoki  

H. H. Glaeser, H. W. Dogen, and J. P. Hunt  

Formation of Spiromonatriene and Heptafulvene from an Attempt to Generate Cycloheptaethylidenes.  
W. M. Jones and C. L. Ennis  

Cyclopropanones.  
R. Breslow and G. Ryan  

The Isolation and Structural Elucidation of Thalidasine, a Novel Bisbenzylisouquinoline Alkaloid Tumor Inhibitor from Thalictrum dasycarpum.  
S. H. Kopchan, T.-H. Yang, G. S. Vasilikiotis, M. H. Barnes, M. L. King  

Photochemical and Base-Catalyzed Rearrangements of Isoxazolidines.  
N. A. Label, T. A. Lajiness, and D. B. Leslie  

A Novel Photoinduced Ring Expansion of 1-t-Butyl-3-phenyl-1-benzylazetidine.  
A. Padwa, R. Gruber, and L. Hamilton  

Sterospecific Rearrangements in the Homocubyl Cation.  
J. C. Berborak, and R. Pettit  

"Stable Carbonium Ions: XXXIII. Primary Alkoxycarbonium Ions"  
G. A. Olah, D. H. 00, and G. S. Reddy  

"Stable Carbonium Ions. XL. Protonated Aliphatic Thiols and Sulfides and Their Cleavage to Carbonium Ions"  

"Delocalization of the 11-Electron System in 1,4-Dihydropyridine(YPyrazines)"  
A. M. Aguiar, K. C. Hansen, and G. S. Reddy  

"Formation of Spiromonatriene and Heptafulvene from an Attempt to Generate Cycloheptaethylidene"  
W. M. Jones and C. L. Ennis  

"photochemical Conversion of 7-Methoxycyclononatriene to 1-Methoxybicyclo[3.2.0]hepta-3,6-diene"  
G. W. Borden, O. L. Chapman, R. Swindell, and T. Tezuka  

"Stable Carbonium Ions. Neighboring Group Anisotropies and Charge Distributions.  
H. H. Glaeser, H. W. Dogen, and J. P. Hunt  

"The Coordination Number of Aluminum(III) in Liquid Ammonia"  
E. H. Glasser, H. W. Dogen, and J. P. Hunt  

"Halide Ions as Probes for Nuclear Magnetic Resonance Studies of Proteins. The Sulphydryl Groups of Hemoglobin"  
T. R. Stengle and J. D. Baldeschwieler  

"haplophytine"  
I.D. Rae, R. Rosenberger, A.G. Sabo, C.R. Willis, Peter Yates  

"Nuclear Magnetic Resonance Spectroscopy. Benzene-13,C14"  
F. J. Weigert and J. D. Roberts  
"Structures of the Indole Alkaloids Koparine and Kopasporine"  
D. W. Thomas, K. B€omann, A. R. Klare, and R. D. Armstrong  
J. Am. Chem. Soc. 89, 1235 (1967)

"Novel Analgesics and Molecular Rearrangements in the Naphtho-Tetralin System. IV. Acid-Catalyzed Rearrangements of Alcohols in the 6,14-endo-Exothetahydroacridine Series"  
E. W. Bentley, D. G. Hardy, and D. S. Week  
J. Am. Chem. Soc. 89, 3293 (1967)

"Stereocchemistry of Formation of Cyclooctatrienes via the Photochemistry of Thiophenes. V. Investigation of Phenylium Ion Rearrangements by Deuteron Labeling Techniques"  
R. H. Schlessinger and I. S. Ponticello  
J. Am. Chem. Soc. 89, 3600 (1967)

"Interaction and Association of Bases and Nucleosides in Aqueous Solutions. V. Studies of the Association of Protamine and Purine Nucleosides by Vapor Pressure Osmometry and by Proton Magnetic Resonance"  
M. T. Cava, and N. M. Pollack  
J. Am. Chem. Soc. 89, 3639 (1967)

"Reactive Tetravalent Sulfur Intermediates. A Heterocyclic Thiophosphate"  
R. L. Cava, and N. M. Pollack  
J. Am. Chem. Soc. 89, 3639 (1967)

"Selective Aromatic Heterocycles Containing "Tetravalent Sulfur"  
R. L. Cava, and N. M. Pollack  
J. Am. Chem. Soc. 89, 3641 (1967)

"The Mechanism and Synthetic Utility of the Oxidative Cleavage of Ethers by Aqueous Bromine"  
N. G. Dolo and N. H. Trotter  
J. Am. Chem. Soc. 89, 3550 (1967)

"Stable Carbonium Ions. XI. Protonated Aliphatic Aldehydes and their Cleavage to Carbonium Ions"  
G. A. Olah, D. H. O'Brien, and M. Calin  
J. Am. Chem. Soc. 89, 3740 (1967)

"Stable Carbonium Ions. XLIII. Protonated Aliphatic Ketones"  
G. A. Olah, M. Calin, and D. H. O'Brien  
J. Am. Chem. Soc. 89, 3586 (1967)

"Stable Carbonium Ions. XLIV. The Cleavage of Protonated Aliphatic Carboxylic Acid to Alkylcarbonium Ion"  
O. A. Olof, and A. M. White  
J. Am. Chem. Soc. 89, 3591 (1967)

"Unsaturated Heterocyclic Systems. XXXI. New Aspects of the Heterocyclic Ion to 1,3-Dihydro-2-oxopyrimidine Ring Expansion"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Total Synthesis of 4(3H)-Chinone"  
H. W. Whitlock, Jr., and G. L. Smith  
J. Am. Chem. Soc. 89, 3600 (1967)

"Nuclear Magnetic Resonance Studies of Exchange in chlorinated Alcohols and Their Cleavage to Carbonium Ions"  
W. G. Dauben and J. L. Wiseman  
J. Am. Chem. Soc. 89, 3556 (1967)

"Solvolytic of Bicyclo[2.1.0]pentane-1-methyl 2-Nitrobenzoate"  
W. G. Dauben and J. L. Wiseman  
J. Am. Chem. Soc. 89, 3556 (1967)

"Studies of Chemical Exchange by Nuclear Magnetic Resonance. II. Hindered Rotation in Amides and Thioamides"  
R. C. Newson, Jr., D. H. Roark, and V. Jonas  
J. Am. Chem. Soc. 89, 3412 (1967)

"Ketones, and Proton Exchange in the teta-Trans 4-Methyl-2-dimethylamino) cobalt(III) Ion"  
P. A. Buckingham, L. G. Hanzlik, and A. M. Sargeson  
J. Am. Chem. Soc. 89, 3412 (1967)

"Nuclear Magnetic Resonance Studies of Exchange in Stannylamines"  
E. W. Kendall, G. R. Vorder, and H. J. Zuckerman  
J. Am. Chem. Soc. 89, 3438 (1967)

"Application of Deuteron Nuclear Magnetic Resonance spectroscopy to the Study of the Coupling Reactions of 1-Chlorocyclohexene and 1-Chlorocycclohexene with Phenyllithium"  
J. Am. Chem. Soc. 89, 3453 (1967)

"The Stereospecific Synthesis and Electronic Absorption Properties of cis- and trans-4-Acetoxyopsine"  
J. G. Sikkema and R. N. Wilson  
J. Am. Chem. Soc. 89, 3657 (1967)

"The Vapor-Phase thermolyses of 3-Hydroxy-1,5-hexadienes. Effects of Methyl Substitution"  
J. Am. Chem. Soc. 89, 3652 (1967)

"The Photochemistry of Thioephene. V. Investigation of Phenylium Ion Rearrangements by Deuteron Labeling Techniques"  
R. H. Schlessinger and B. W. Wynberg  
J. Am. Chem. Soc. 89, 3695 (1967)

"The Photochemistry of Thioephene. VI. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Photochemistry of Thioephene. VII. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Photochemistry of Thioephene. VIII. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Photochemistry of Thioephene. IX. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Photochemistry of Thioephene. X. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Photochemistry of Thioephene. XI. Photorearrangement of Phenyliumthiophenones"  
L. A. Faquato and W. C. Farley  
J. Am. Chem. Soc. 89, 3595 (1967)

"The Total Synthesis of 4-Chinone"  
H. W. Whitlock, Jr., and G. L. Smith  
J. Am. Chem. Soc. 89, 3600 (1967)

"Interconversion and Association of Bases and Nucleosides in Aqueous Solutions. V. Studies of the Association of Protamine and Purine Nucleosides by Vapor Pressure Osmometry and by Proton Magnetic Resonance"  
A. D. Brown, W. F. Scheinman and P. E. Y. Tao  
J. Am. Chem. Soc. 89, 3612 (1967)

"Reactive Tetravalent Sulfur Intermediates. A Heterocyclic Thiophosphate"  
R. L. Cava, and N. M. Pollack  
J. Am. Chem. Soc. 89, 3639 (1967)

"Reactive Aromatic Heterocycles Containing "Tetravalent Sulfur"  
R. L. Cava, and N. M. Pollack  
J. Am. Chem. Soc. 89, 3641 (1967)
"Preparation of Alkoxysulfonium Salts by Oxidation of Sulfoxides with Positive Halogen Compounds"
C. H. Johnson and M. P. Jones
J. Org. Chem. 32, 2034 (1967)

"Evidence against Aziridine Intermediates in the Reaction of Acids with Dithyroglycan" 
P. Schenker

"A New Synthesis of Methyl Vinyl Phosphate" 
P. C. De Selms and T.-W. Lin
J. Org. Chem. 32, 2033 (1967)

"The Structures of Chlorofenchenephosphonic Acid and Chlorobromofenene" 
A. J. Fry
J. Org. Chem. 32, 2025 (1967)

"The Nitration of 2-Nitro-1,4-dialkylbenzenes"
H. J. Fabris

"A New Synthesis of Diethyl Vinyl Phosphate"
P. A. Krapcho and B. P. Mundy
J. Org. Chem. 32, 2036 (1967)

"The Reaction of Epichlorohydrins with p-Butyl- and Allyllithium" 
E. J. DeLong and M. J. Northcott
J. Org. Chem. 32, 2029 (1967)

"Reaction of Methyl and Ethyl 2-Cyclopentenecarboxylates with Amines to Give Carboalkalamines, Enamines, and Amidines" 
P. J. Pennington and M. D. Kehret
J. Org. Chem. 32, 2034 (1967)

"Investigation of the Claimed Synthesis of 1,1-(Oxidylethyldiaziridine" 
P. F. Donovan, W. R. Smith, and D. A. Conley
J. Org. Chem. 32, 2029 (1967)

"Amide Derivatives of 1,2,3,4,7-Hexachloro-3-hydroxy-5-sulfotricyclo[2.2.1.0°°]heptane Sulfolene" 
B. Veldhuis
J. Org. Chem. 32, 2026 (1967)

"Synthesis of cis,cis-4,8-Dimethyl-cis-9-oxa-6-ketodeacrylonitrile. A Precursor in an Attempted Synthesis of Beta-Vetivone" 
A. T. Kuroko and B. P. Mundy
J. Org. Chem. 32, 2031 (1967)

"Preparation of Alkoxysulfonium Salts by Oxidation of Sulfoxides with Positive Halogen Compounds"
C. H. Johnson and M. P. Jones
J. Org. Chem. 32, 2034 (1967)

"Evidence against Aziridine Intermediates in the Reaction of Acids with Dithyroglycan" 
P. Schenker

"A New Synthesis of Methyl Vinyl Phosphate" 
P. C. De Selms and T.-W. Lin
J. Org. Chem. 32, 2033 (1967)

"The Structures of Chlorofenchenephosphonic Acid and Chlorobromofenene" 
A. J. Fry
J. Org. Chem. 32, 2025 (1967)

"The Nitration of 2-Nitro-1,4-dialkylbenzenes"
H. J. Fabris

"A New Synthesis of Diethyl Vinyl Phosphate"
P. A. Krapcho and B. P. Mundy
J. Org. Chem. 32, 2036 (1967)

"The Reaction of Epichlorohydrins with p-Butyl- and Allyllithium" 
E. J. DeLong and M. J. Northcott
J. Org. Chem. 32, 2029 (1967)

"Reaction of Methyl and Ethyl 2-Cyclopentenecarboxylates with Amines to Give Carboalkalamines, Enamines, and Amidines" 
P. J. Pennington and M. D. Kehret
J. Org. Chem. 32, 2034 (1967)

"Investigation of the Claimed Synthesis of 1,1-(Oxidylethyldiaziridine" 
P. F. Donovan, W. R. Smith, and D. A. Conley
J. Org. Chem. 32, 2029 (1967)

"Amide Derivatives of 1,2,3,4,7-Hexachloro-3-hydroxy-5-sulfotricyclo[2.2.1.0°°]heptane Sulfolene" 
B. Veldhuis
J. Org. Chem. 32, 2026 (1967)

"Synthesis of cis,cis-4,8-Dimethyl-cis-9-oxa-6-ketodeacrylonitrile. A Precursor in an Attempted Synthesis of Beta-Vetivone" 
A. T. Kuroko and B. P. Mundy
J. Org. Chem. 32, 2031 (1967)
"Ricerche sulla enamine. — Nota XXV. Sull' enamine
de metil-n-alclhicocondi" 
D. Pocar, G. Bianchetti et F. Ferruti 

"Die Struktur des quartären Alkaloids Macrosalphin" 
Z. M. Khan, M. Hesse und H. Schmid 

"Catalyse acide de certaines réactions nucléophiles
en série phosphorante. - Action de l'énamide
clorourée sur les acétylacrylamidé-thiono-
phosphores" 
P. A. Chapard 

"Interactions entre les phosphites alcoylés et le groupe
carbonyl; transformation des phosphites méthyles
dans l'acide actique" 
P. A. Chapard 

"Recherches dans la série des cycloitoxx XXXV. Sur des
complexes polyédriques, tungstiques et boriques de
cyc loftoux" 
Th. Posternak, D. Jaudic, E. A. C. Locken et A. Szente 

"Cyclische, gekreuzt-konjugierte Bindungssysteme. XXIII.
NMR.-Untersuchungen am Phenasilven-System" 
H. Prinzlach, V. Freudenberger und U. Schloeder 

"Beiträge zur Chemie der Si-N-Bindung. - Oligo-
silazane und N=N-Iminoschwefeldifluoridmethan" 
O. Glemser und U. Biermann 

"Alkyl- and Arylaluminum Complexes. I. The Reaction of Trialkyl-
and Triaryltinanium with Bidentate
Legands" 
T. J. Hurley, M. A. Robinson, J. A. Scruggs, and S. I. Trotz 
Inorg. Chem. 6, 1310 (1967)

"Chemistry of the Cyclopentadienylmetal Carbonyls. VII.
Nucleophile Substitution Reactions of Cyclopentadienyl-
iron-, tungsten-, and -molibdenum Carbonyl Cations" 
P. M. Treichel and R. L. Shubkin 
Inorg. Chem. 2, 1326 (1967)

"Chemistry of the Cyclicpentadienylmetal Carbonyls. VIII.
Bis- and Tris-Pentacarbynylniobiums and
-therynes Derivatives of Tin" 
J. A. J. Thompson and W. A. G. Graham 
Inorg. Chem. 6, 1365 (1967)

"New Olefinic Compounds of Platinum(0)" 
S. Genini, K. Ugo, F. Bonati and G. La Monica 

"Fluorocarbon-Alkyn Complexes of Transition Metals" 
R. S. Dickson and D. B. W. Yawney 

"Uber die Darstellung von N-Cyaninoiminoschwefeldifluorid
und N,N'-Eminoschwefeldifluoridfluoromethan" 
O. Glemser und U. Biermann 

"A Nuclear Magnetic Resonance Study of Steric Effects in
cis- and trans-1,4-Dichloro-2-butenim" 
H. G. Hecht and B. L. Victor 
J. Am. Chem. Soc. 89, 2552 (1967)

"Proton and Phosphorus-31 Nuclear Magnetic Resonance
Studies of Tetraalkoxyphosphonium Hexachloroantimonates
and Related Compounds" 
J. S. Cohen 
J. Am. Chem. Soc. 89, 2543 (1967)

"The Chemistry of Methylnorbornyl Cations. II. Sources
and Identification of Sixteen of the Methylnorbornyls" 
J. A. Berson, A. W. McKow, R. C. Bergman and D. Houston 
J. Am. Chem. Soc. 89, 2563 (1967)

"The Chemistry of Methylnorbornyl Cations. III. Con-
figurational Correlation of 2,3- and 2,7-Substituted
Norbornyl Derivatives by Way of 3-Substituted
Norrocyclenes" 
J. A. Berson and R. G. Bergman 
J. Am. Chem. Soc. 89, 2569 (1967)

"The Chemistry of Methylnorbornyl Cations. VI. The
Stereochemistry of Vicinal Hydride Shift, Evidence for
the Nonclassical Structure of 3-Methyl-2-norbornyl
Cations" 
J. A. Berson, J. H. Hammons, A. W. McKow, R. G. Bergman, 
A. Remanick, and D. Houston 
J. Am. Chem. Soc. 89, 2590 (1967)
"Notiz über 1,2-Dibenzoyloxy-Ethilen"  
R. Kuhn and E. Teller  
Chem. Ber. 100, 2120 (1967)

"A Total Synthesis of (±)-Glaziovine by Phenolic Oxidative Coupling"  
T. Kametani and H. Yagi  
Chem. Commun. 366 (1967)

"A Three-stage Synthesis of a Nickel Corrin Perchlorate from Pyrrolic Intermediates"  
R. Gigg, A. N. Johnson, and P. van den Broek  
Chem. Commun. 502 (1967)

"Restricted Rotation in Substituted Acreiphpenones and Benzaldehydes: an Interesting Solvent Effect"  
R. E. Klinck, D. H. Marr, and J. B. Stothers  
Chem. Commun. 409 (1967)

"Novel Heteroaromatic Compounds Related to Acrephylidiene"  
A. R. J. Arturh, P. Flowciday and H. J. Perkins  
Chem. Commun. 410 (1967)

"Valence Tautomerism in Cyclo-octetetraenuronium Tricarbonyl"  
M. I. Bruce, N. Cooke, M. Green, and F. G. A. Stone  
Chem. Commun. 523 (1967)

"A Three-stage Synthesis of a Nickel Corrin Perchlorate from Pyrrolic Intermediates"  
R. Grigg, A. N. Johnson, and P. van den Broek  
Chem. Commun. 502 (1967)

"Mono- and Di-carbonium Ions from 1,3-Diketones"  
D. M. Brouwer  
Chem. Commun. 515 (1967)

"The Structure of the α-Methylacrylene Tetramer"  
K. Frater and K. Zeile  
Chem. Commun. 416 (1967)

"The Co-ordination of Small Molecules by Bitriphenyl-phosphineplatinum(0); The Reaction with H₂, H₂Se, and H₂Te"  
D. Morelli, A. Segre, R. Ugo, G. La Monica, S. Ceinini, F. Conti, and F. Bonati  
Chem. Commun. 324 (1967)

"The Replacement of Sulphonyloxy-groups at C-4 in Pyranosides"  
L. N. Owen  
Chem. Commun. 326 (1967)

"Restricted Rotation in Substituted Acreiphpenones and Benzaldehydes: an Interesting Solvent Effect"  
R. E. Klinck, D. H. Marr, and J. B. Stothers  
Chem. Commun. 409 (1967)

"A Three-stage Synthesis of a Nickel Corrin Perchlorate from Pyrrolic Intermediates"  
R. Grigg, A. N. Johnson, and P. van den Broek  
Chem. Commun. 502 (1967)

"The Stereochemistry of Formosanine (Uncarine B) and Uncarine A"  
A. F. Beecham and H. K. Hart, S. R. Johns, and J. A. Lamberton  

"The Synthesis of Unsaturated Adenine Nucleosides Related to Angustmycin A"  
J. R. McCarthy, Jr., M. J. Robins, and R. K. Robins  
Chem. Commun. 536 (1967)

"The Photochemistry of 2,3-Dimethyl-1-phenyl-3-pyrazolin-5-one"  
S. N. Ege  
Chem. Commun. 488 (1967)

"The Identity of Neoxanthin and Folilaxanthin"  
A. K. Millems, E. S. Wright, and B. C. L. Weeden, L. Cholnoky, K. Gyorgyfi, and J. Szebócs, N. F.  
Krisny and B. P. Schmidt  
Chem. Commun. 486 (1967)

"The Stereochemistry of Formosanine (Uncarine B) and Uncarine A"  

"The Synthesis of Unsaturated Adenine Nucleosides Related to Angustmycin A"  
J. R. McCarthy, Jr., M. J. Robins, and R. K. Robins  
Chem. Commun. 536 (1967)

"Organometallic Insertion Reactions of Diketen; Synthesis of β-Keto-esters"  
J. R. Horder and M. F. Lappert  
Chem. Commun. 485 (1967)

"Proton Nuclear Magnetic Resonance Spectroscopic Studies of Aromatic Hydrocarbons; Induced Paramagnetic Ring-current in the Four-membered Ring of Biphenylene and Related Hydrocarbons"  
B. P. Fglava  
Chem. Commun. 495 (1967)

"The Replacement of Sulphonyloxy-groups at C-4 in Pyranosides"  
L. N. Owen  
Chem. Commun. 326 (1967)

"The Structure of the α-Methylacrylene Tetramer"  
K. Frater and K. Zeile  
Chem. Commun. 416 (1967)

"The Identity of Neoxanthin and Folilaxanthin"  
A. K. Millems, E. S. Wright, and B. C. L. Weeden, L. Cholnoky, K. Gyorgyfi, and J. Szebócs, N. F.  
Krisny and B. P. Schmidt  
Chem. Commun. 486 (1967)

"The Co-ordination of Small Molecules by Bitriphenyl-phosphineplatinum(0); The Reaction with H₂, H₂Se, and H₂Te"  
D. Morelli, A. Segre, R. Ugo, G. La Monica, S. Ceinini, F. Conti, and F. Bonati  
Chem. Commun. 324 (1967)

"The Replacement of Sulphonyloxy-groups at C-4 in Pyranosides"  
L. N. Owen  
Chem. Commun. 326 (1967)

"Stereoisomerization of Perfluoro-(1-methyleneisopropylamine)"  
P. H. Ogdon and G. V. D. Tiers  
Chem. Commun. 527 (1967)

"New Indolo[3,2-a][1,2-q]-β-carbolines"  
K. Frater and K. Zeile  
Chem. Commun. 415 (1967)

"Valence Tautomerism in Cyclo-octetetraenuronium Tricarbonyl"  
M. I. Bruce, N. Cooke, M. Green, and F. G. A. Stone  
Chem. Commun. 523 (1967)

"The Identity of Neoxanthin and Folilaxanthin"  
A. K. Millems, E. S. Wright, and B. C. L. Weeden, L. Cholnoky, K. Gyorgyfi, and J. Szebócs, N. F.  
Krisny and B. P. Schmidt  
Chem. Commun. 486 (1967)

"The Co-ordination of Small Molecules by Bitriphenyl-phosphineplatinum(0); The Reaction with H₂, H₂Se, and H₂Te"  
D. Morelli, A. Segre, R. Ugo, G. La Monica, S. Ceinini, F. Conti, and F. Bonati  
Chem. Commun. 324 (1967)

"An Abnormal Deshielding Effect on a Methine Proton by a Neighbouring Acetyl Group"  
S. Takada, K. Yamada, S. Nakamura, and Y. Hirata  
Chem. Commun. 538 (1967)
"Structure of Phycocyanobilin"
H. L. Crespi, L. J. Boucher, G. D. Norman, J. J. Katz, and R. C. Dougherty
J. Am. Chem. Soc. 89, 3642 (1967)

"The Structure of Phycocyanobilin"
W. J. Cole, R. J. Chapman, and H. W. Siegelman
J. Am. Chem. Soc. 89, 3643 (1967)

"Substituted Bicyclo[2.1.0]pentanes"
T. H. Kinstle, R. L. Welch, and R. W. Exley
J. Am. Chem. Soc. 89, 3643 (1967)

"The Relationship of Spectral Changes and Tritium Exchange to the Mechanism of Tryptophanase-catalyzed Reactions"
J. A. Weil, A. Blum, A. H. Heiss, and J. K. Kinnard
J. Chem. Phys. 46, 3132 (1967)

"Fluorine Exchange in Sulfur Tetrafluoride"
E. I. Nasternik and W. D. Phelps
J. Chem. Phys. 46, 2861 (1967)

"Comment on Fluorine Exchange in Sulfur Tetrafluoride"
R. L. Redington, and C. V. Berney

"ERRATUM: Spin-Echo NMR Studies of Chemical Exchange. III. Conformational Isomerization of Cyclohexane and d5-Cyclohexane""A. Allerhand, P. M. Chen, and H. S. Gutowsky

"Fluorine Exchange in Sulfur Tetrafluoride"
E. I. Nasternik and W. D. Phelps
J. Chem. Phys. 46, 2861 (1967)

"Fluorine Exchange in Sulfur Tetrafluoride"
E. I. Nasternik and W. D. Phelps
J. Chem. Phys. 46, 2861 (1967)

"Nuclear Magnetic Resonance in Rare-Earth-Aluminum Intermetallic Compounds RA1""A. M. van Diepen and H. W. de Gijn, and R. J. J. Buschow

"Proton Relaxation in Potassium-Ammonia Solutions"
R. A. Newmark, J. C. Stephens and J. E. Haug

"NMR Study of Ferroelectric LiNO3 and LiFeO3.1"G. E. Peterson, P. M. Brittenhough, and F. Green

"Proton NMR Spectra of Ni(CNS)2+ and Ce(NCS)62+ in Dimethyl Sulfoxide""S. Thomas and W. L. Reynolds

"Precise Evaluation of the Proton-Proton Coupling Parameters in Cyclopropane"V. S. Watts and M. Goldstein
J. Chem. Phys. 46, 4165 (1967)

"Amino Acid NMR Spectra of Boronic Acid: Physical Properties and Structures"H. J. Campbell-Pearsall and Z. A. V. Howorth


"The Reaction of Potassium Pentacyanocobaltate(II) with Hydrogen"M. G. Burnett, F. J. Connolly, and R. Kemball

"Pseudohalides. Part II. Infrared, Ultraviolet, and Proton Magnetic Resonance Spectra of Boron Isocyanoates and Isocyanocyanates"M. F. Lappert and H. Pyszora

"Nuclear Magnetic Resonance in Transition-metal Complexes"K. Bradley, D. N. Piggot, and R. S. Nyholm
"Action de la thiouree sur les oxetannes générateurs d'oxydes de phosphine stabilisés (3 et 4)
rentrant dans la série des phosphinéthyl-2 thiazoles"

H. Sliwa

"Synthèse de nouveaux composés hétérocycliques"

V. Silve

"A study of the Structure of Dihalogenoalkanes by Proton Magnetic Resonance"

Yu. A. Buslaev and V. A. Shcherbakov
Dok. - Chem. Sect. (English Transl.), 170, 909 (1966)

"Radical Addition of Thiols to Alkenylcyclopropanes"

V. D. Esentupar, G. G. Yakobson, and Academician N. N. Vorovitch
Dok. - Chem. Sect. (English Transl.), 170, 975 (1966)

"Use of Proton Magnetic Resonance to Study the Structure of Uranyl Nitrate Hexahydrate"

V. M. Vakovchenko, N. M. Aleksandrov, A. P. Sokolov, and V. A. Shcherbakov
Dok. - Phys. Chem. Sect. (English Transl.), 170, 609 (1966)

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Dok. - Chem. Sect. (English Transl.), 170, 909 (1966)

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Dok. - Phys. Chem. Sect. (English Transl.), 170, 609 (1966)

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Dok. - Phys. Chem. Sect. (English Transl.), 170, 609 (1966)

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Dok. - Chem. Sect. (English Transl.), 170, 909 (1966)

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Dok. - Chem. Sect. (English Transl.), 170, 975 (1966)

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V. M. Vakovchenko, N. M. Aleksandrov, A. P. Sokolov, and V. A. Shcherbakov
Dok. - Phys. Chem. Sect. (English Transl.), 170, 609 (1966)

"A Study of the Structure of Dihalogenoalkanes by Proton Magnetic Resonance"

Yu. A. Buslaev and V. A. Shcherbakov
Dok. - Chem. Sect. (English Transl.), 170, 909 (1966)
Commun. 650 (1967)

"Synthesis of Isobutalin Methyl Ester"
T. R. Kasturi, G. R. Pettit, and K. A. Jaeggi
Commun. 644 (1967)

"Nuclear Spin-Spin Interactions. Effect of Nitrogen-14 in 2-Ethoxyindoles and 2-Ethylthioindoles: their Autoxidation and Reactions with Piperidine"
T. R. Kasturi, G. R. Pettit, and K. A. Jaeggi
Commun. 656 (1967)

"Effect of the deuscription on the resonance magnetic nuclease of the protons in CGC. 68.9°: l'état antiferromagnétique"
M. Benoît, J.-P. Legrand and J.-P. Resnard

"La liaison Arsenic-oxygène: étude par spectrographie infrarouge et par résonance magnétique nucléaire (E.P.) des éthers organiques et aromatiques"
J.-P. Laurent, M. Durand and P. Gallais

"Addition radicale de l'éthanol et de l'éthanal sur le b-quinone"
R. Lallande, R. Paszkoff and M. Cazaux
Compt. Rend., Ser. C, 266, 1083 (1967)

"Alcaloides stéroïdiens:Role de l'hexaméthylphosphoramide (HMP) solvant dipolaire, dans la substitution et l'élimination des tolyoxy-25 stéroïdiens"
H. Leboeur, A. Cave, and R. Goutauri

"Transpositions du méthyle-2 cyclohexyl-3 butane dion-2.3 de la tétrabutyldicycloxydètes et du méthyle-3 cyclohexyl-3 butane-2"
G. Groc, J. Giral, G. Casulli and T. Roumey

"Synthèse d'acides α-alliènes"
G. Gelin, E. Gelin and R. Albran

"Action du sodium sur des mélanges de cétone α, β-éthyléniques et d'acrylonitrile"
J. Chaballier, C. Courtois, M. L. Bougerra and J. Wismann

"Action de la dichlorure d'iodeboréne sur l'acide endo-norbornène-5 carboxylique-2, sur l'acide endo-norbornène-5 dicarboxylique-2,1 et son mydèide"
S. Masson et A. Tillyer

"Transposition en milieu acide de cécalcools alléniques"
M. Bertrent and C. Kouvier

"Préparation de α-tris(cyclohexyl) acrylonitriles"
Y. Courthéoux-Bassire, J.-F. Monodgard and E. Berco
"Synthèse et époxidation des cyclo [4,3–0]–monoxénes–3
sul et trans-cyclo [3,3–0]–monoxénes–3 sul et trans
R. Casasavall et M. J. J. Jallageas

"Contribution de moments diylaires à l’étude des interactions soluté-solvant dans le cas où le soluté présente une isomérie de rotation"
A. Abédée, C. Michel et P. Mauret

"Sur quelques composés hétérocycliques du phosphore"
R. Wolf, R. Burgada, M. Sanchez et fun
J.A. Gautier, M. Miocque et L. Mascrier-Demagny

"Cétones arylique et aliphatique à fonction acétyle numérique. II – Transformations par réactions d’addition"
J. A. Gautier, M. Mioque et L. Mavoungou-Dombe

"Isomérisation acide des tocoguaiinones, I – Dimérisation et condensation avec le diphenyl-1,1 éthylène"
P. Mamont, P. Cohen et R. Azerad

"Cétones arylaliphatiques à fonction acétyle numérique. II – Transformations par réactions d’addition"
J. A. Gautier, M. Mioque et L. Mavoungou-Dombe

"Epoxynitriles IV : Utilisation pour une méthode générale de synthèse des alpha fluoroarboxyylés. Étude physicochimique"
J. Cadecouber et D. Richard

"Condensation et acétylation de l’acide orthophosphorique en présence d’amphényl acétique. Étude par résonance magnétique nucléaire"
Cl. Borréaux-Korin, et M. J. M. Verdier, M. H. Vincent

"Stéréochimie. XV – Bromocétènes de la série du méthyl-5,5–19–nor chloroalénène"
A. Demarche, C. Gast, J.-C. Jacquesy, J. Levisalles et L. Schaeffer

"Stéréochimie. XVII – Addition de l’acide fluorhydrique amphotère sur les dérivés du cholestérol. Remarques sur la réduction des cétones par les hydrures mixtes"
J.-C. Jacquesy, R. Jacquesy et J. Levisalles

"Etude de la méthylisation par la diméthylène des hydroylés de composés amers des Simarubacées"
A. Gauldure, J.-L. Fourrey et J. Polonsky

"Substitution nucléophile sur un carbone éthylénique, étude de l’action des organomagnésiens sur les nitriles α-halogenoconnectiques"
G. Boulayrand et R. Vezaire

"Synthèse asymétrique par action d’un réactif chiral sur un substrat comportant au moins un centre asymétrique; relation entre les quantités des quatre énantiomères formés"
J.-F. Quittet et A. Moreau

"Emploi du furfural en synthèse diénique, I – Condensation des cétones du furfural avec l’amidoxime méthylique et l’acétylénedicarboxylate de méthyle"
L. Mavoungou-Dombe

"Condensation du carboxy-2 benzaldéhyde et du diazoacétate α-éthylène nouveau synthèse de tautomères"
J. Aknin et D. Molho

"Structure et activité oestrone. XXIV – Synthèse d’acides acéto-11,12 dioxyacids"
J. C. Dubois, A. Boreau et R. H. Kagan

"Effets inducifs et mésomères dans les molécules aromatiques substituées. XXI – Dérivés de la pyrimidine et de la s-triazine"
H. Limbruno, C. Gienget, R. Malelizi-Hinskens et P. Fremin

"Structure de l’acide Tyromycique, nouvel acide triterpénoïde isolé de Tyromyces albidus (Polyporee)
A. Gaudemer, J. Polonsky et R. Gmelin

"Aliene chemistry. VIII. Diaddition of thiol compounds to allene"
A. A. Oswald, K. Griesbaum, D. N. Hall, and W. W. Naegele

"The Preparation of 3-alkylthio-2-methoxytetrahydropyrans
M. J. Baldwin and R. K. Brown

"Carcinobi-bridged and Related Compounds. Structural Assignments by Nuclear Magnetic Resonance Spectroscopy"
C. F. H. Allen

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C. F. H. Allen

"Optical and Geometri Isomers of Some Fatty Acids With Vicinal Hydroxy Groups"
D. F. Ewing and C. T. Hopkins

"Cyclisation Antrac-oilique de l'acide benzyl-2 pentène-4 oïques. Préparation de quelques tétra-méthyl-naphtaléines"
P. Camouzet et A. Regnault

"Photolysis of a Medium-ring Nitrosoamide"
G. E. Edwards and R. S. Rosich

"Slow Rotation Around the Benzeno-oxygen Bond in Esters of Phenols"
T. H. Siddall III, W. E. Stewart, and M. L. Good

"The Conformational Analysis of cis-1,4-bromochlorocyclohexane"
G. W. Wood and E. P. Wood

"The Synthesis of the 3,4,6-tri-O-acetyl and 3,4,6-tri-O-methyl-6pyranosyl Fluoride"
G. W. Wood and E. P. Wood

"Reactions of Phenols With Acetic Anhydride - Dimethyl Sulfoxide"
G. W. Wood and E. P. Wood
"Chemistry of Phosphorus Fluorides. Part II. Secondary Alkylamino Derivatives of Phosphoryl Fluoride"  
R. G. Cavalli  

"Coordination Compounds 1,3-Butadiene with Anhydrous Silver Tetrafluoroborate"  
H. W. Quinn  

"Egonol. Spectrometric Properties and Derivatives"  
C. Y. Hopkins, D. F. Ewing, and M. J. Chisholm  

"Reactions of phenyl-substituted Heterocyclic Compounds. VII. Regent-dependent Orientation in the Nitration of 4-phenylpyrimidine"  
B. M. Lynch and L. Poosh  

"Diterpene Chemistry. II. The Preferential Oxidation of the Vinyl Groups of Pinamar and Sandaracopimaric Acids"  

"Conformation of the C15 Lupine Alkaloids"  
M. Wiewiorowski, O. E. Edwards, and M. D. Bratek-Wiewiorowska  

"2-(4-Piperidyl)ethanal and 3-(4-piperidyl)propanal"  
W. L. Meyer and R. G. Olsen  

"Non-equivalence of Vicinal Proton-Fluorine Coupling Constants in a CF3-CH2 Group"  
R. R. Fraser and F. Hanson  

"Acetylation of D-xyllose Diethyl Dithioacetal"  
D. G. Lance and J. K. N. Jones  

"In the Non-equivalence of Isopropyl C6H Nuclear Magnetic Resonance Signals"  
T. S. Sorensen  

"Conversion of (±)-α-D-Glucopyranose and (±)-β-D-Glucopyranose into Hydroxylaldehyde Derivatives"  
F. Piers and K. F. Cheng  

"Substituted Cerebrosides. Part III. 3-O-(4-O-p-D-Galactopyranosyl-β-D-glucopyranosyl)DL-lysine Derivatives"  
H. M. Flowers  
Carbohyd. Res. 4, 42 (1967)

"Ethylidene Derivatives of D-Erythroae, I. 8,3-O-Ethylidene-D-Erythrofuranose"  
J. W. Van Cleve and C. R. Diet  
Carbohyd. Res. 4, 82 (1967)

"Action of bornyl Trichloride on Methyl 3,6-Anhydro-D-Glucopyranoside and the Purnari A Analogue"  
M. A. Bahari, A. B. Foster, and J. M. Webber  
Carbohyd. Res. 4, 105 (1967)

"Dimethylthiocarbamates of Sugars"  
D. Horton and H. S. Prihar  
Carbohyd. Res. 4, 115 (1967)

"4,6-Anhydro Derivatives of L-α-Galactopyranose"  
L. Hough and H. S. Prihar  
Carbohyd. Res. 4, 126 (1967)

"Replacement Nucléophile d’un Ester β-Toluenesulfonique sur Panfurose. Nouvelle Méthode d’accès au 3-Benzoxyl-β-xylopyranosyl-Pentosé"  
J. Delage et J. Biedesheim  
Carbohyd. Res. 4, 154 (1967)

"Synthesis of 2-(6-O-Benzoyl-3,4-O-isopropylidene-D-galactopyranosyl)-L-fucopyranose"  
H. M. Flowers, A. Levy, and N. Sharon  
Carbohyd. Res. 4, 189 (1967)

"Nucleosides and Related Substances. Part VI. The Synthesis of 9-α-D-Ribofuranosyladenine (a-adenosine)"  
K. Godera, S. Niremo, and F. Masuda  
Carbohyd. Res. 2, 263 (1967)

"The Relative Signs of Proton-Proton Spin-Coupling Constants in Saturated and Unsaturated Carbohydrate Derivatives"  
L. B. Gei and J. F. Mansville  
Carbohyd. Res. 4, 271 (1967)

"Synthesis of Benzyl 6-O-Benzyl-3,4-O-isopropylidene-β-D-galactopyranoside and of 2-α-L-Fucopyranosyl-β-D-galactose"  
A. Levy, H. M. Flowers, and N. Sharon  
Carbohyd. Res. 4, 305 (1967)

"Synthesis of Solabioside (3-β-D-glycopyranosyl-β-D-galactose) and 3-α-(β-D-gluco-pyranosyluronic Acid)-β-D-galactose"  
H. M. Flowers  
Carbohyd. Res. 4, 312 (1967)

"An Approach to the Selective Degradation of Poly saccharide Chains"  
N. K. Kochetkov, O. S. Chishev, and A. F. Vserov  
Carbohyd. Res. 4, 362 (1967)

"Darstellung und Untersuchung von Dichlormethylphosphaten und Chlorofluorothiolphosphaten"  
H. W. Keesy  
Chem. Ber. 100, 1447 (1967)

"Cycloalkylcarbaryl-Anionen durch heterolytische Fragmentierung von Azoverbindungen"  
R. W. Hoffmann and K. K. Eicken  
Chem. Ber. 100, 1467 (1967)

"Die Reaktions von Schiffs-Dichlorid mit Acrylester und Acrylnitril sowie ihren Homologen"  
U. Hassnerodt  
Chem. Ber. 100, 1482 (1967)

"Reaktionen der β-Alkoxyalkyle carben"  
W. Kirmse and M. Buschhoff  
Chem. Ber. 100, 1497 (1967)

"Die Polyline der Gattung Carlina L."  
F. Rohmann and K.-M. Rode  
Chem. Ber. 100, 1507 (1967)

"Organogallogermoxane"  
B. Armer and H. Schmidt  
Chem. Ber. 100, 1521 (1967)

"Uberg die Vilsmeier-Formylierung von umgesättigten Kohlenwasserstoffen. 11"  
G. Jutz and W. Muller  
Chem. Ber. 100, 1536 (1967)
Die Cyclisierung von Octahydro-isochinolin derivaten durch Morphinan-Ringschluß. Synthese des Dihydrothebains

"Zur Anlagerung des Diphenylnitrilimins an nichtkonjugierte Alkene und Alkine; Sterischer Ablauf, Orientierung und Substituenteneinfluß"

Diphenylnitrilimin und arylkonjugierte Alkene: e

Reaktionen der Azomethine mit Isothiocyanaten und Schwefelkohlenstoff

Einige Umsetzungen des 3.4-Dihydro-isochinolins mit elektrophilen CC-Mehrfachbindungen
M. Morikawa und R. Huisgen Chem. Ber. 100, 1616 (1967)

Die Darstellung von α-Acetyl-α-lactamen durch Ringschluß

Cycloadditionen mit Dihydronorharnann
E. Winterfeldt und H. Radunz Chem. Ber. 100, 1680 (1967)

"Photo-Cycloadditionen mit Furucumarinen und Furochromonen"

"Indigos Fabstoffe aus α-Oxo-pyrrol-Derivaten"
H. Bauer Chem. Ber. 100, 1704 (1967)

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"Die Cyclisierung von Octahydro-isochinolin derivaten durch Morphinan-Ringschluß. Synthese des Dihydrothebains"

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Diphenylnitrilimin und arylkonjugierte Alkene: e

Reaktionen der Azomethine mit Isothiocyanaten und Schwefelkohlenstoff

Einige Umsetzungen des 3.4-Dihydro-isochinolins mit elektrophilen CC-Mehrfachbindungen
M. Morikawa und R. Huisgen Chem. Ber. 100, 1616 (1967)

Die Darstellung von α-Acetyl-α-lactamen durch Ringschluß

Cycloadditionen mit Dihydronorharnann
E. Winterfeldt und H. Radunz Chem. Ber. 100, 1680 (1967)

"Photo-Cycloadditionen mit Furucumarinen und Furochromonen"

"Indigos Fabstoffe aus α-Oxo-pyrrol-Derivaten"
H. Bauer Chem. Ber. 100, 1704 (1967)

"Analyse der beiden stereoisomeren 2-Carboxyadamantanone (4)"
"Hydrogen Bonding in Phenol + Base Complexes by N.M.R."
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"Protonen-Kernmagnetresonanzuntersuchungen einiger Polyalkohole, Hydroxysäuren und Derivate von D-Glucosäure"
D. T. Sawyer und J. R. Brannan

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A. Müller, E. Niecke und O. Glemser

"Kernresonanzuntersuchungen an Elektrolytlösungen. II. Der Einfluß von paramagnetischen Ionen auf die Li7-Kernresonanzlinie"
W. Hasenfratz, G. Heckmann, P. Ihlenburg und O. Lutz
Z. Naturforsch., 22a, 583 (1967)

"Protonenresonanz-Spektroskopie ungesättigter Ringsysteme" (Cycloheptatrien-(1.3.5) und Cycloheptatrien-(1.3.5)-molybdän-tricarbonyl"
H. Günter und R. Wenzel
Z. Naturforsch., 22b, 652 (1967)

"Kernrelaxation und Spindiffusion in organischen Festkörpern mit paramagnetischen Radikalszentren"
J. Haupt und W. Müller-Warmuth
Z. Naturforsch., 22a, 647 (1967)

"Zur Analyse der Kernresonanzspektrums des Cyan-allsens"
D. Wendisch
Z. Naturforsch., 22b, 353 (1967)

"Über die Dr-, Raman- und 31P-NMR-Spektren einiger Phosphinderivate von Germanium und Zinn"
O. Engelhardt, P. Helch, und H. Schumann
Z. Naturforsch., 22b, 392 (1967)

"Über die IR-, Raman- und 31P-NMR-Spektren einiger Phosphinderivate von Germanium und Zinn"
O. Engelhardt, P. Helch, und H. Schumann
Z. Naturforsch., 22b, 392 (1967)

"Zur Analyse der Kernresonanzspektrums des Cyan-allsens"
D. Wendisch
Z. Naturforsch., 22b, 353 (1967)

"Über die IR-, Raman- und 31P-NMR-Spektren einiger Phosphinderivate von Germanium und Zinn"
O. Engelhardt, P. Helch, und H. Schumann
Z. Naturforsch., 22b, 392 (1967)

"Iron Carbonyl Complexes of β-Carotene and Lycopene"
M. Ichikawa, M. Tsutsui, und F. Vohwinkel
Z. Naturforsch., 22b, 376 (1967)

"Über die IR-, Raman- und 31P-NMR-Spektren einiger Phosphinderivate von Germanium und Zinn"
O. Engelhardt, P. Helch, und H. Schumann
Z. Naturforsch., 22b, 392 (1967)

"Kernmagnetische Resonanz" (Berlin, New York, Springer-Verlag. 1966.)
Conformational Changes in Heterocyclic Analogues of 
Metacyclophane. Interactions between Nonbonded Electron 
Pairs
I. Gault, B. J. Price, and I. S. Sutherland
Chem. Commun. 540 (1967)

Biogenetic Synthesis of Cularine-type Compounds
T. Kametani, T. Kikuchi, and K. Fukumoto
Chem. Commun. 546 (1967)

The Structure of Glaupalol, a Novel 
Glaucidium palmatum Sieb. et Zucc.
H. Irie, Su Ye o, and K. Yamamoto
Chem. Commun. 547 (1967)

The Tetracyclic Triterpenes from Cedrela odorata L.
W.R. Chan and D.R. Taylor, G. Snatzke and H. -W. Fehlhaber
Chem. Commun. 548 (1967)

The Absolute Configuration of Sulphoxides: 3-Thiacholestane 
Oxides and 1, 8,8-Trimethyl-3-thiabicyclo(4,2,1)octane 
Oxides
R. Nagarajan, B. H. Chollar, and R. M. Dodson
Chem. Commun. 550 (1967)

The Absolute Configuration of Sulphoxides: 2-Thia-5α 
androstan-17β-ol Oxides
P. B. Sollman, R. Nagarajan, and R. M. Dodson
Chem. Commun. 552 (1967)

The Stereochemistry of Norbaceine and Herbaline
I. Ogyunov and B. Pyuskulev, M. Shamma, J. A. Wiss 
and R. J. Shine
Chem. Commun. 579 (1967)

The Formation of Dihydropyrans from Dehydrochlorination of 
Chlorocyclopentanes
T. G. Shields, B. A. Loving and P. D. Gardner
Chem. Commun. 550 (1967)

The Absolute Configuration of Sulphoxides: 3-Thiacholestane 
Oxides and 1, 8,8-Trimethyl-3-thiabicyclo(3,2,1)octane 
Oxides
R. Nagarajan, B. H. Chollar, and R. M. Dodson
Chem. Commun. 550 (1967)

Direct Observation of Cyclopropanes from Dehydrochlorination of 
Chlorocyclopropanes
T. G. Shields, B. A. Loving and P. D. Gardner
Chem. Commun. 550 (1967)

The Formation of Dihydropyrans from cis-Hex-3-ene-2,5-dione 
And Fulvenes
M. T. Hughes and R. O. Williams
Chem. Commun. 559 (1967)

Synthesis of 2-Aminoadamantan-1-ol
W. V. Curran and R. S. Anglee
Chem. Commun. 563 (1967)

Extractive Components from the Wood of Taiwania 
cryptomerioides Hayata; the Structures of "γ-cadinal" 
and "γ-murrolol"
Y. S. Cheng, Y. H.Kuo, and Y. T. Lin
Chem. Commun. 565 (1967)

Nuclear Magnetic Resonance Study of a Lithium-exchange 
Reaction
G. W. Canters, H. van Willigen, and E. de Boer
Chem. Commun. 566 (1967)

Structure of Mono-, Di-, and Tri-protonated Biguanides
K. M. Willsman and B. L. Harris, and F. J. Murphy
Chem. Commun. 568 (1967)

Synthetic Approaches to the Cyclohexa[def]fluorene 
System
R. Munday and I. O. Sutherland
Chem. Commun. 569 (1967)

Hydrogen Cyanide as a Ligand in Liquid Hydrogen 
Fluoride
M. P. A. Dove and J. G. Hallett
Chem. Commun. 571 (1967)

The Synthesis of (±)-Bakuchiol
J. Carnsuff and A. J. Miller
Chem. Commun. 606 (1967)

The Photochemistry of Hydroxy-cyclohexadienones
G. F. Bartkiewicz, B. A. Davis, and P. D. Woodgate
Chem. Commun. 607 (1967)

The Structure of Mono-, Di-, and Tri-protonated Biguanides
K. M. Willsman and B. L. Harris, and F. J. Murphy
Chem. Commun. 568 (1967)

The Stereochemistry of Norbaceine and Herbaline
I. Ogyunov and B. Pyuskulev, M. Shamma, J. A. Wiss 
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Chem. Commun. 579 (1967)

1,6-Addition of a Grignard Reagent to Anthraquinone
D. W. Cameron and W. Meckel
Chem. Commun. 623 (1967)

Nitration of Some 2,3-Dihydro-1,4-Diazepinium 
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C. Barnett
Chem. Commun. 637 (1967)

Extensive Delocalization in Potassium Bicyclo(3,2,1) 
Octadeceny1ide
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Chem. Commun. 638 (1967)


The Chemistry of Pyrrolic Compounds. V. β-Methoxy- and β-Hydroxy-porphyrins
R. Chong and P. S. Clezy
Australian J. Chem. 20, 951 (1967)

The Chemistry of Pyrrolic Compounds. VI. Chlorines and β-Aldehydes
Y. Chang, P. S. Clezy, and D. B. Morell
Australian J. Chem. 20, 957 (1967)

The Chemistry of Pyrrolic Compounds. VIII. Australian J. Chem. 20, 1029 (1967)
L. N. Mander, E. Ritchie, and W. C. Taylor

The Chemical Constituents of Galbulimima Species. VI. The Structure of Himandridine
L. M. Mander, E. Ritchie, and W. C. Taylor
Australian J. Chem. 20, 993 (1967)

The Chemical Constituents of Galbulimima Species. VII. The Correlation of Himandridine and Himbosine
L. N. Mander, E. Ritchie, and W. C. Taylor
Australian J. Chem. 20, 1011 (1967)

The Chemical Constituents of Galbulimima Species. VIII. Studies of Cycloheximide-Related Compounds. III. A Novel Reaction of Aromatic Nitroketones with Aldehydes and Secondary Amines
S. Bussana and Y. Agawa

The Flavonoids of Cyanostegia Angustifolia and Cyanostegia Microphylla
E. L. Chisábé, J. R. Jeffries, and C. I. Stacey
Australian J. Chem. 20, 1049 (1967)

The in Vivo Metabolism of 16α-Hydroxydehydroandrosterone in Man
E. Younglad and S. Solomon

A Nuclear Magnetic Resonance Study of Substrate Binding by Alcohol Dehydrogenases
D. P. Hollis
Biochem. 4, 2040 (1967)

Mechanisms of Pyrrole Additions
J. A. Bove, E. A. Price, and A. H. Redcliffe
Australian J. Chem. 20, 1041 (1967)

The Correlation of Himandridine and Himbosine
R. Chong and P. S. Clezy
Australian J. Chem. 20, 969 (1967)

Analyse des spectres de RMN du thiamine et de l'acétone
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