

Texas
 A
 M
 &
 University
 N - M - R
 Newsletter

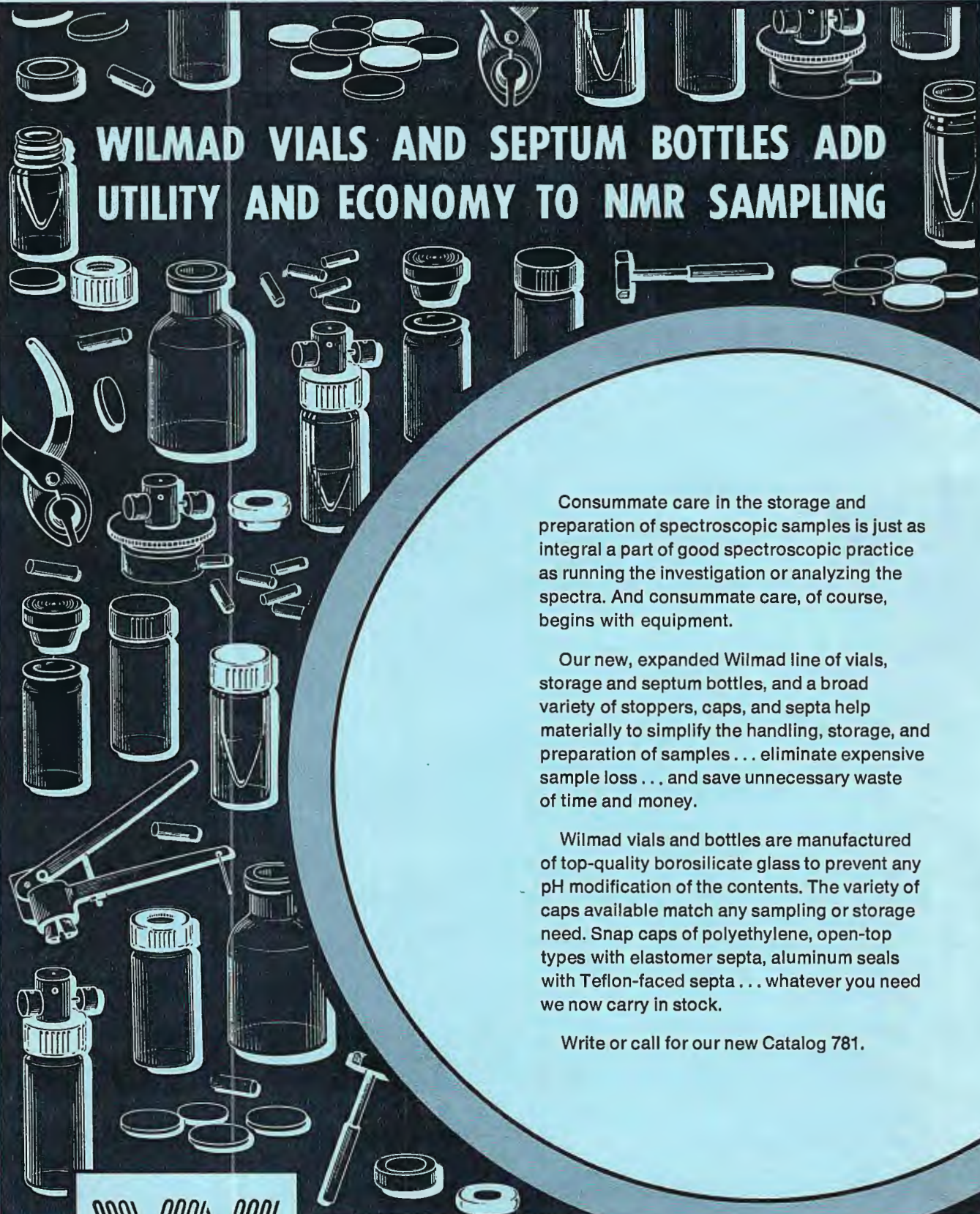
No. **255**

December, 1979

T. L. James and P. H. Bolton Conformational Flexibility in Nucleic Acids via ^{13}C NMR.	1	R. Gerhards The Importance of Phase Correction for Quantitative ^{13}C -NMR-Spectroscopy of High- and Non-Boiling Mineral Oil Samples.	32
E. M. Menger, J. W. M. van Os and W. S. Veeman Magic Angle Spinner	3	C. Brevard Think Deuterium!	35
L. D. Hall A Progress Report from U.B.C.	5	B. H. Arison Direct Observation of Peptide Protons in CD_3OD and D_2O	37
A. Hunt Peptide Sequencing by NMR	8	J. B. Robert and J. Martin Long-Range Phosphorus-Carbon Couplings.	39
C. H. A. Seiter and S. G. Angelos ^{19}F pH Monitor <u>In Vivo</u>	11	G. Waksman, C. Garbay-Jaureguiberry and B. P. Roques Conformational Preferences in Synthetic Fluorescent Probes of the C_nDACHol Type	41
A. Allerhand Carbon-13 NMR of Glycopeptides and Glycoproteins; Postdoctoral Openings	13	G. R. Eaton NMR and EPR Symposia.	43
C. E. Holloway Metal-Hormone Complexes.	16	G. D. Barnard Postdoctoral Position Wanted	45
K. D. Berlin ^{31}P and ^{13}C NMR Analysis of Long-Chain, Alkyl-Substituted Phosphine Oxides	17	A. S. Perlin NMR Research Spectroscopist Position	46
D. W. Ovenall and F. N. Tebbe Deuterium NMR Study of Titanium-Catalyzed Olefin Metathesis.	19	W. C. Hutton NMR Spectrometers For Sale.	47
K. A. O. Starzewsky and P. S. Pregosin One-Bond Platinum-195 Tin-119 Coupling Constants	21	E. Birnbaum JEOL PS-100 For Sale.	47
M. A. Hemminga and P. A. de Jager NMR and Flowing Water	24		
J. M. Williams ^{13}C NMR of Sugar Hydrazones in Hydrazine; Broad Peaks in Spectra of Alkaloid Glycosides	25		
G. E. Hawkes Peptide Proton Exchange by ^{15}N NMR	27		

A monthly collection of informal private letters from Laboratories of NMR. Information contained herein is solely for the use of the reader. Quotation is not permitted, except by direct arrangement with the author of the letter, and the material quoted must be referred to as a "Private Communication". Reference to the TAMU NMR Newsletter by name in the open literature is strictly forbidden.

These restrictions apply equally to both the actual Newsletter participant-recipients and to all others who are allowed access to the Newsletter issues. Strict adherence to this policy is considered essential to the successful continuation of the Newsletter as an informal medium of exchange of NMR information.



WILMAD VIALS AND SEPTUM BOTTLES ADD UTILITY AND ECONOMY TO NMR SAMPLING

Consummate care in the storage and preparation of spectroscopic samples is just as integral a part of good spectroscopic practice as running the investigation or analyzing the spectra. And consummate care, of course, begins with equipment.

Our new, expanded Wilmad line of vials, storage and septum bottles, and a broad variety of stoppers, caps, and septa help materially to simplify the handling, storage, and preparation of samples . . . eliminate expensive sample loss . . . and save unnecessary waste of time and money.

Wilmad vials and bottles are manufactured of top-quality borosilicate glass to prevent any pH modification of the contents. The variety of caps available match any sampling or storage need. Snap caps of polyethylene, open-top types with elastomer septa, aluminum seals with Teflon-faced septa . . . whatever you need we now carry in stock.

Write or call for our new Catalog 781.



WILMAD GLASS COMPANY, INC.

World Standard in Ultra Precision Glassware

Route 40 & Oak Road • Buena, N.J. 08310 U.S.A.

Phone: (609) 697-3000 • TWX 510-687-8911

TAMU NMR NEWSLETTER - ADVERTISERS

Bruker Instruments, Inc. - see p. 6
 JEOL Analytical Instruments, Inc. - see p. (1) and outside back cover
 Merck Sharp & Dohme Canada, Ltd. - see p. 18
 Nicolet Instrument Corporation - see inside back cover
 Programmed Test Sources, Inc. - see p. 30
 Varian Instrument Division - see p. 22
 Wilmad Glass Company, Inc. - see inside front cover

TAMU NMR NEWSLETTER - SPONSORS

Abbott Laboratories
 Bruker Instruments, Inc.
 JEOL Analytical Instruments, Inc.
 Dr. R. Kosfeld, Abt. Kernres., Inst. f. Phys. Chem.,
 TH Aachen (Germany)
 The Monsanto Company
 Nicolet Technology Corp., Palo Alto, CA
 (formerly Transform Technology, Inc.)
 Shell Development Company
 Unilever Research
 Varian, Analytical Instrument Division

TAMU NMR NEWSLETTER - CONTRIBUTORS

The British Petroleum Co., Ltd. (England)
 E. I. DuPont DeNemours & Company
 Eastman Kodak Company
 Intermagnetics General Corporation
 The Lilly Research Laboratories, Eli Lilly & Co.
 The NMR Discussion Group of the U.K.
 The Perkin-Elmer Company
 Pfizer, Inc.
 The Procter & Gamble Co., Miami Valley Labs
 Programmed Test Sources, Inc.
 Union Carbide Corporation
 Xerox Corp., Webster Research Center

DEADLINE DATES:	No. 256	7 January 1980
	No. 257	4 February 1980

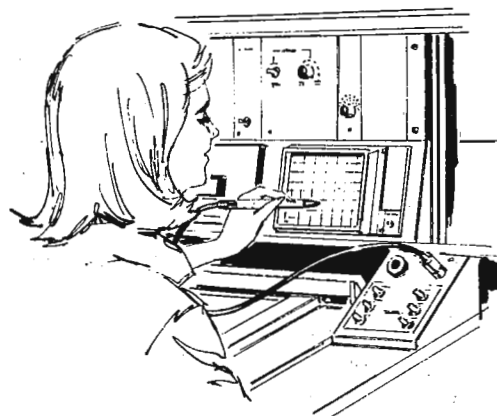
All Newsletter Correspondence, Etc., Should Be Addressed To:

Dr. Bernard L. Shapiro
 Department of Chemistry
 Texas A&M University
 College Station, TX 77843 U.S.A.

AUTHOR INDEX - TAMU NMR NEWSLETTER NO. 255

Allerhand, A.....13	de Jager, P. A.....24
Angelos, S. G.....11	James, T. L.....1
Arison, B. H.....37	Martin, J.....39
Barnard, G. D.....45	Menger, E. M.....3
Berlin, K. D.....17	van Os, J. W. M.....3
Birnbaum, E.....47	Ovenall, D. W.....19
Bolton, P. H.....1	Perlin, A. S.....46
Brevard, C.....35	Pregosin, P. S.....21
Eaton, G. R.....43	Robert, J. B.....39
Garbay-Jaureguiberry, C.41	Roques, B. P.....41
Gerhards, R.....32	Seiter, C. H. A.....11
Hall, L. D.....5	Starzewsky, K. A. O.....21
Hawkes, G. E.....27	Tebbe, F. N.....19
Hemminga, M. A.....24	Veeman, W. S.....3
Holloway, C. E.....16	Waksman, G.....41
Hunt, A.....8	Williams, J. M.....25
Hutton, W. C.....47	

For those who expect more in FT NMR Spectrometers ... it's JEOL



The FX60Q, FX90Q & FX200 Feature:

- (DQD) DIGITAL Quadrature Detection System
- Multi-Frequency TUNEABLE Probe observation
- Dual Frequency probes
- 4-channel DIGITAL phase shifters (DPS)
- Comprehensive auto-stacking system
- Foreground/Background system
- Computer based pulse programmer with Multiple Pulse Sequence Generator
- CPU Expandable to 65K words (MOS)
- 2-channel 12 bit AD/DA
- $T_1\rho$ /spin locking system
- Disc storage systems
- Multi-Mode HOMO/HETERO decoupling capabilities
- Programmable Variable Temperature Unit
- Simplex Y/Curvature gradient controller

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO



SANTA BARBARA • SANTA CRUZ

SCHOOL OF PHARMACY
DEPARTMENT OF PHARMACEUTICAL CHEMISTRY

SAN FRANCISCO, CALIFORNIA 94143

October 31, 1979

Professor B.L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77843Re: Conformational Flexibility in Nucleic Acids via ^{13}C NMR

Dear Barry:

We have been studying the mobility of nucleic acids using ^{31}P (1,2) and ^{13}C NMR relaxation. The NMR experiments include the off-resonance $T_{1\rho}^{\text{off}}$ experiment (3), as well as T_1 and NOE measurements. The Figure shows the natural-abundance ^{13}C NMR spectra of the ribose region for poly(A) at 25.1 MHz, unfractionated yeast tRNA at 25.1 MHz, and calf thymus DNA at 50.3 MHz, all at 20-30°C. Aromatic carbons could not be observed for DNA (recycle time 0.625s), and could be barely observed for tRNA and poly(A). The bases of the nucleic acids apparently are relatively immobile. Internal motions (e.g., puckering in the ribose ring) enable the protonated ribose carbons to be observed. Analysis of the relaxation data indicate that the internal motion is in the nanosecond time range in all cases. The local motion correlation times of the different nucleic acids are quite similar with the exception that the 2'-carbon of DNA and poly(A) appears to be less restricted than that for tRNA.

- (1) P.H. Bolton and T.L. James, J. Am. Chem. Soc., in press.
- (2) P.H. Bolton and T.L. James, J. Phys. Chem., in press.
- (3) T.L. James, G.B. Matson, and I.D. Kuntz, J. Am. Chem. Soc. 100, 9490 (1978).

Sincerely,

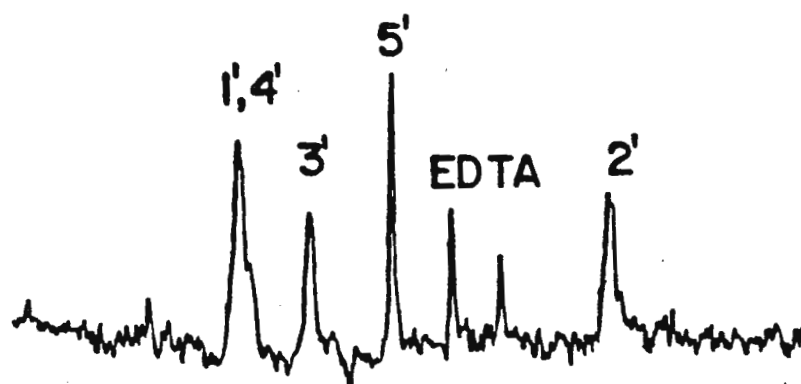
*Tom*Thomas L. James
Assistant Professor of Chemistry
and Pharmaceutical Chemistry*Philip*

Philip H. Bolton, Ph.D.*

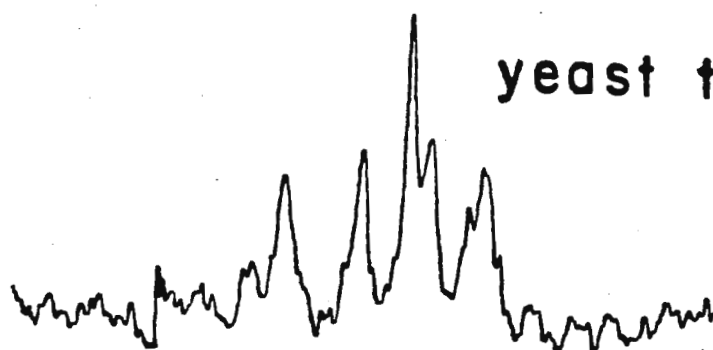
TLJ:dc

*New Address: Department of Chemistry
Wesleyan University
Middletown, CT 06457

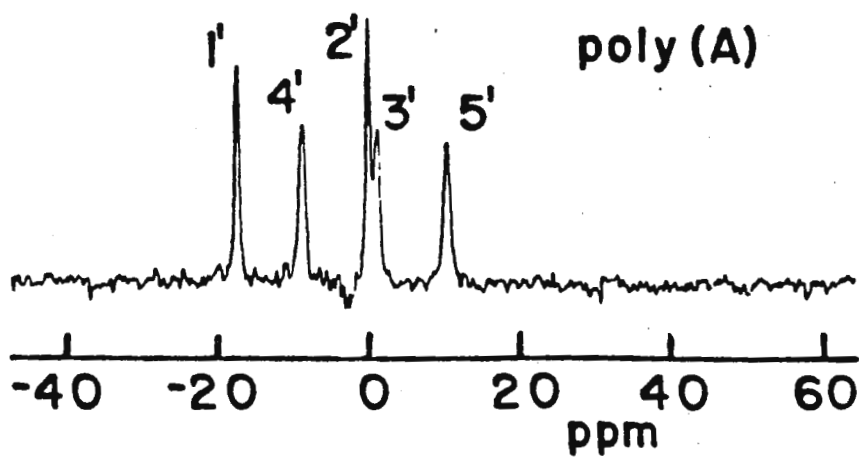
Calf Thymus DNA



yeast tRNA



poly (A)





LABORATORIUM VOOR FYSISCHE CHEMIE

FACULTEIT DER WISKUNDE
EN NATUURWETENSCHAPPEN
KATHOLIEKE UNIVERSITEIT
NIJMEGEN, NEDERLAND

Toernooiveld
Nijmegen
Telefoon (080) 55 88 33

Prof. B.L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77843
U.S.A.

Uw kenmerk

Uw brief van

Ons kenmerk
U4630/WV/dw

Datum 31th October, 1979

Onderwerp Magic angle spinner.

Dear Prof. Shapiro,

High resolution solid state NMR via dipolar decoupling and magic angle spinning requires, especially at high magnetic fields, a high speed spinner.

Spinners, presently in use in many laboratories, can be divided mainly in two categories: conical spinners as have been used by Andrew and coworkers [1] and cylindrical spinners according to Lowe [2]. Both spinners are reported to work satisfactory, although our own experience with an "Andrew" type spinner showed that the orientation of the spinner rotation axis is influenced by slight unbalances of the rotor and depends on the rotation speed.

We want to report here the design of another spinner which has been in use in our laboratory for about one year. It runs stable (continuously for weeks if necessary) at speeds up to 7 kHz when propelled by compressed air and the orientation of the rotation axis is confined between very narrow limits.

The figure shows an impression of the rotor and the spinner housing. The cylindrical spinner (DELRIN or KEL-F, center part length 19 mm, ϕ 10 mm, with 2x11 flutes; end pieces, length 9 mm each and ϕ 7.75 mm) fits in two air bearings (ϕ 8 mm) with 2x6+1 holes in each.

Low pressure air (< 0.1 atm.) is sufficient to make an air bearing. High pressure air (up to 6 atm.) is fed into two jets connected to a PVC block which can be moved up and down to adjust distance and angle of jets relative to the flutes on the rotor. The NMR coil, not shown in the figure, is around the rotor between the flutes. To change spinners, one can easily remove one bearing.

The sample chamber in the spinners is closed by two, very close fitting plugs (ϕ 4 mm, long 9 mm) in the end pieces. For KEL-F spinners we use as sample chamber dimensions: ϕ 5x10 mm, for DELRIN ϕ 7x10 mm.

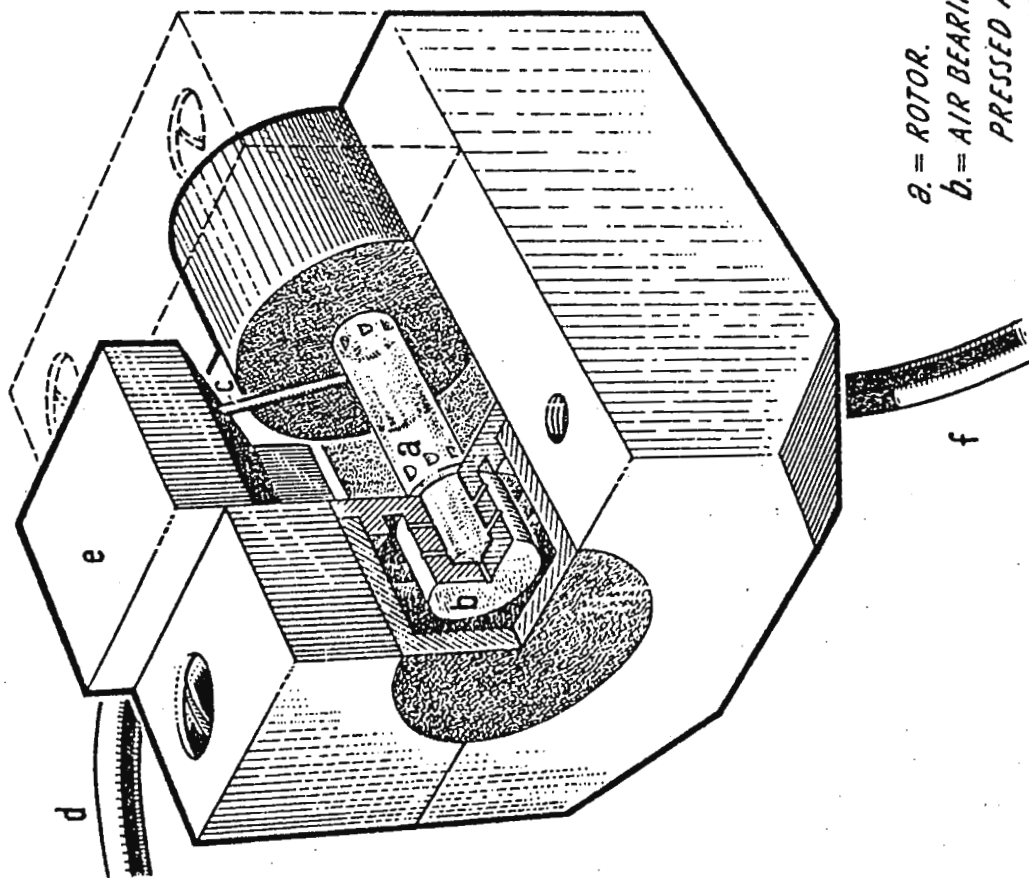
- [1] E.R. Andrew in: Progress in NMR spectroscopy, vol. 8, ed. J.W. Emsley, J. Feeney and L.H. Sutcliffe (Pergamon Press, Oxford, 1972).
[2] I.J. Lowe, Phys. Rev. Letters 2 (1959) 285.

Sincerely yours,

E.M. Menger

J.W.M. van Os

W.S. Veeman



a. = ROTOR.

b. = AIR BEARING, 2x6 HOLES
PRESSED AIR FROM HOSE

c. = 2 JETS PRESSED AIR VIA
HOSE d AND BLOCK e.

d. = HOSE.

e. = BLOCK; CAN BE MOVED u
AND DOWN TO ADJUST
DISTANCE AND RELATIVE
ANGLE OF JETS.

f. = HOSE.

THE UNIVERSITY OF BRITISH COLUMBIA
2075 WESBROOK MALL
VANCOUVER, B.C., CANADA
V6T 1W5

DEPARTMENT OF CHEMISTRY

November 7, 1979.

Professor Barry L. Shapiro
Department of Chemistry
Texas A. and M. University
College of Science
College Station
Texas 77843
U.S.A.

A Progress Report from U.B.C.

Dear Barry,

Many apologies for the long delay in my response to your numerous missives.... I hope that the news below will convince you that this has not been due to idleness on my part.

This year has seen a major expansion in the N.M.R. facilities of this Department. We have installed three new instruments from Bruker: a WP-80 with broad band probes, a WH-400 also with broad-band probes, and a CXP-200 which includes facilities for ^{13}C magic angle spinning/cross polarisation. All three instruments are now installed and we are slowly learning how to exploit their exciting potential.

In addition, my home-built/Nicolet 270 MHz is now functional for proton and carbon-13 using home-built probes, lock, decoupler, heteronuclear adaptor, etc. We are using this principally for our two-dimensional n.m.r. studies which are proving to be both productive and interesting. Since it is my intention to write to you separately on this topic, I'll not comment further at this point beyond noting that as Sukumar Subramaniam and I have already reported {J. Amer. Chem. Soc., 101, 3120-3121 (1979)} proton 2D J spectroscopy provides a rather versatile means for distinguishing between homonuclear and heteronuclear scalar couplings ~ the former are suppressed in the 45° projection of the 2D J spectrum and the latter are suppressed in the partial J spectra. Of course all of this requires no probe modification ~ indeed no spin-decoupler!

This exemplifies just one of the many delightful new opportunities which are becoming available to the practicing chemist.

With all best regards.

Laurie Hall

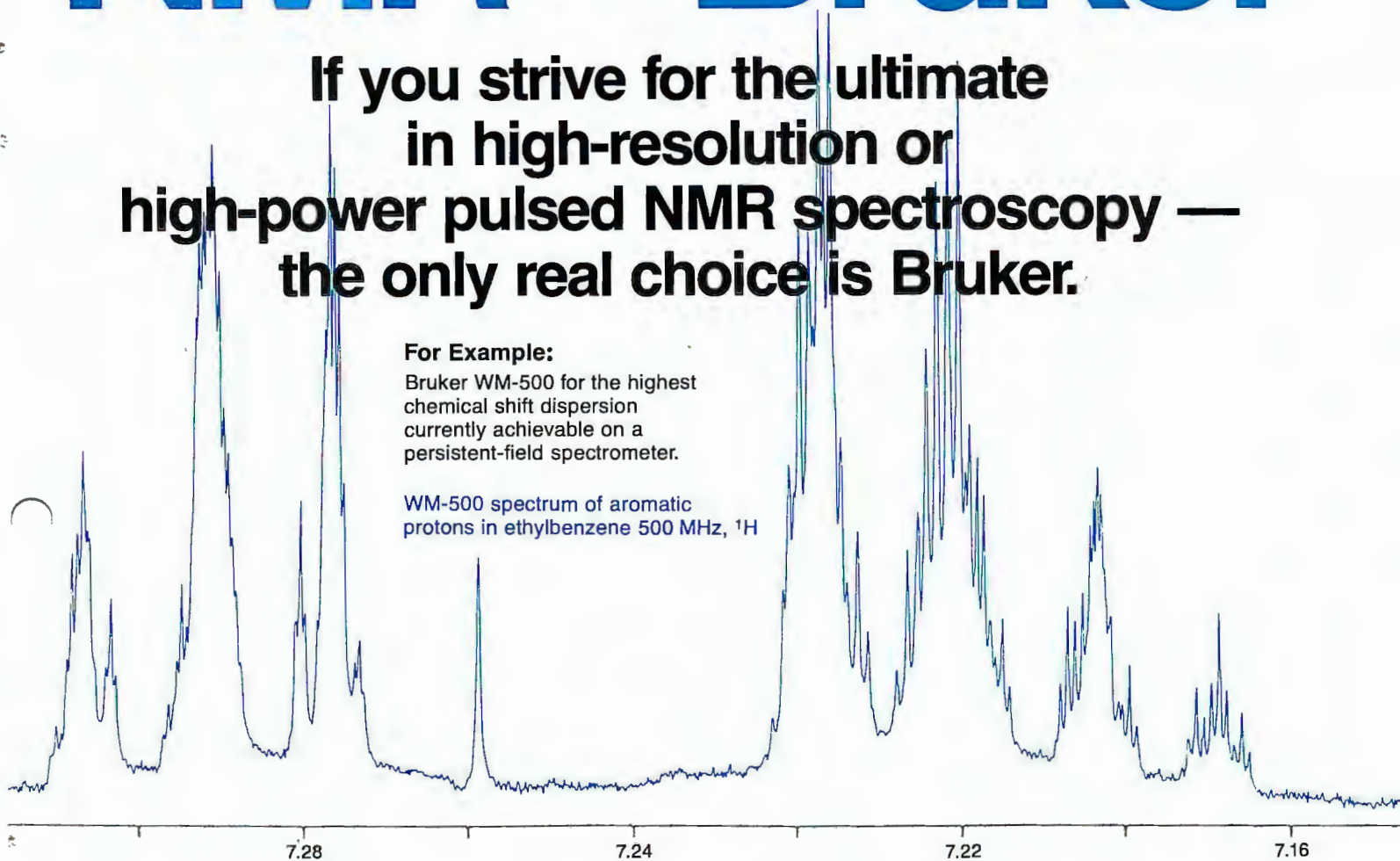
Bruker \equiv NMR NMR \equiv Bruker

If you strive for the ultimate
in high-resolution or
high-power pulsed NMR spectroscopy —
the only real choice is Bruker.

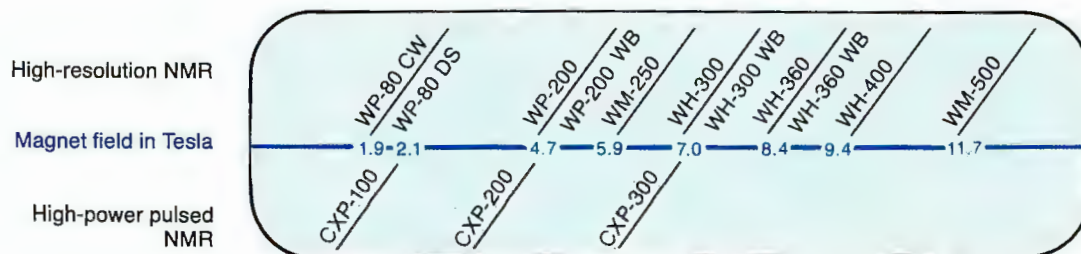
For Example:

Bruker WM-500 for the highest
chemical shift dispersion
currently achievable on a
persistent-field spectrometer.

WM-500 spectrum of aromatic
protons in ethylbenzene 500 MHz, ^1H



Whether your NMR needs are governed by scientific demands or
budgetary constraints, Bruker is the only real choice. No other manufacturer
offers as complete a product line as we do:



Bruker also manufactures EPR
spectrometers, electromagnets
and high-current power supplies.



Bruker Instruments, Inc.
Manning Park, Billerica, MA 01821
Tel. (617) 667-9580



**For information on NMR and EPR
instrumentation and accessories
your prime source
is the nearest Bruker office:**

Bruker Instruments, Inc.
Manning Park, Billerica, MA 01821
(617) 667-9580

201 San Antonio Circle, Suite 152
Mountain View, CA 94040
(415) 941-3804

539 Beall Ave., Rockville, MD 20850
(301) 762-4440

1603 Darwin Court, Wheaton, IL 60187
(312) 668-4441

LILLY RESEARCH LABORATORIES

DIVISION OF ELI LILLY AND COMPANY • INDIANAPOLIS, INDIANA 46206 • TELEPHONE (317) 636-2211

November 9, 1979

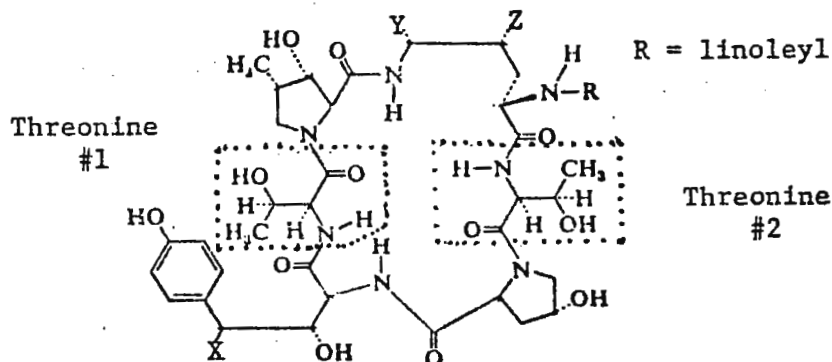
Title:

Peptide Sequencing by NMR

Professor B. L. Shapiro
 Department of Chemistry
 Texas A & M University
 College Station, Texas 77843

Dear Professor Shapiro:

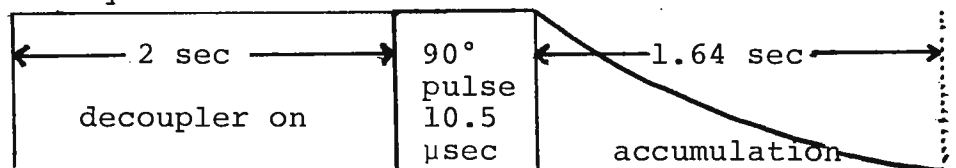
The echinocandins B, C, and D are antifungal antibiotics with closely related structures which have recently been reported (1); all three are cyclic hexapeptides connected to a linoleic acid residue in an amide linkage:



Echinocandin B: X = Y = Z = OH
 Echinocandin C: X = H; Y = Z = OH
 Echinocandin D: X = Y = Z = H

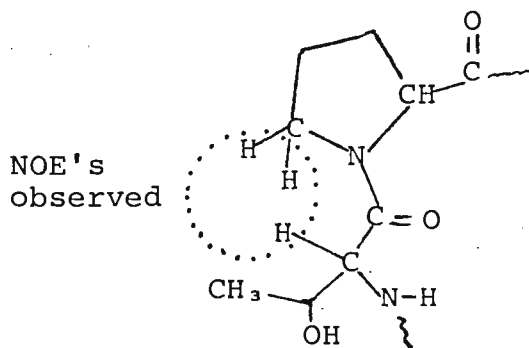
The high resolution and sensitivity of our Bruker WH360 spectrometer have allowed the total assignment of the proton nmr spectrum of each of these peptides in DMSO- d_6 , with the exception of the hydroxyl groups (2). The initial assignments, however, did not allow us to distinguish between the two threonine residues, even though these residues are non-equivalent. In order to resolve this question and complete the nmr assignments for these peptides, we have attempted an application of the NOE-peptide sequencing methods developed by Gibbons *et al.* (3). Readers of the TAMU Newsletter may be interested in our results.

For our purposes it was not necessary to obtain a precise quantitative measurement of the NOE's observed; the time intervals which we have used, therefore, were chosen for convenience rather than for optimized NOE results. We have used the sequence



The decoupler is switched on immediately after accumulation, eliminating the delay usually used to allow for the establishment of equilibrium after the 90° pulse. An FID is accumulated (about 200 scans) with the decoupler on the peak of interest; from this we subtract a reference FID, identical except that the decoupler has been moved to a region of the spectrum containing no resonances. The resulting difference FID is transformed to produce the difference NOE spectrum.

We have observed several NOE's by this procedure which will be useful in describing the shape of these molecules in solution. The most pertinent observations for the assignment of the threonine residues involve NOE's between the threonine α protons and the δ protons of the adjacent prolines:



These NOE's are obtained for both threonine α CH's. However, the two proline residues are different (hydroxyproline and methylhydroxyproline), thus allowing the assignments given below:

	NH*	α CH	β CH	γ CH ₃
Threonine #1	7.38	4.65	3.98	1.07
Threonine #2	8.03	4.70	4.29	1.07

*Chemical shift in DMSO-d₆ from internal TMS

In the attached sample spectrum irradiation at one of the δ protons of methylhydroxyproline has produced an NOE at the other δ proton resonance and at the α CH of threonine #1.

Please credit this contribution to the Eli Lilly account.

Sincerely,

LILLY RESEARCH LABORATORIES

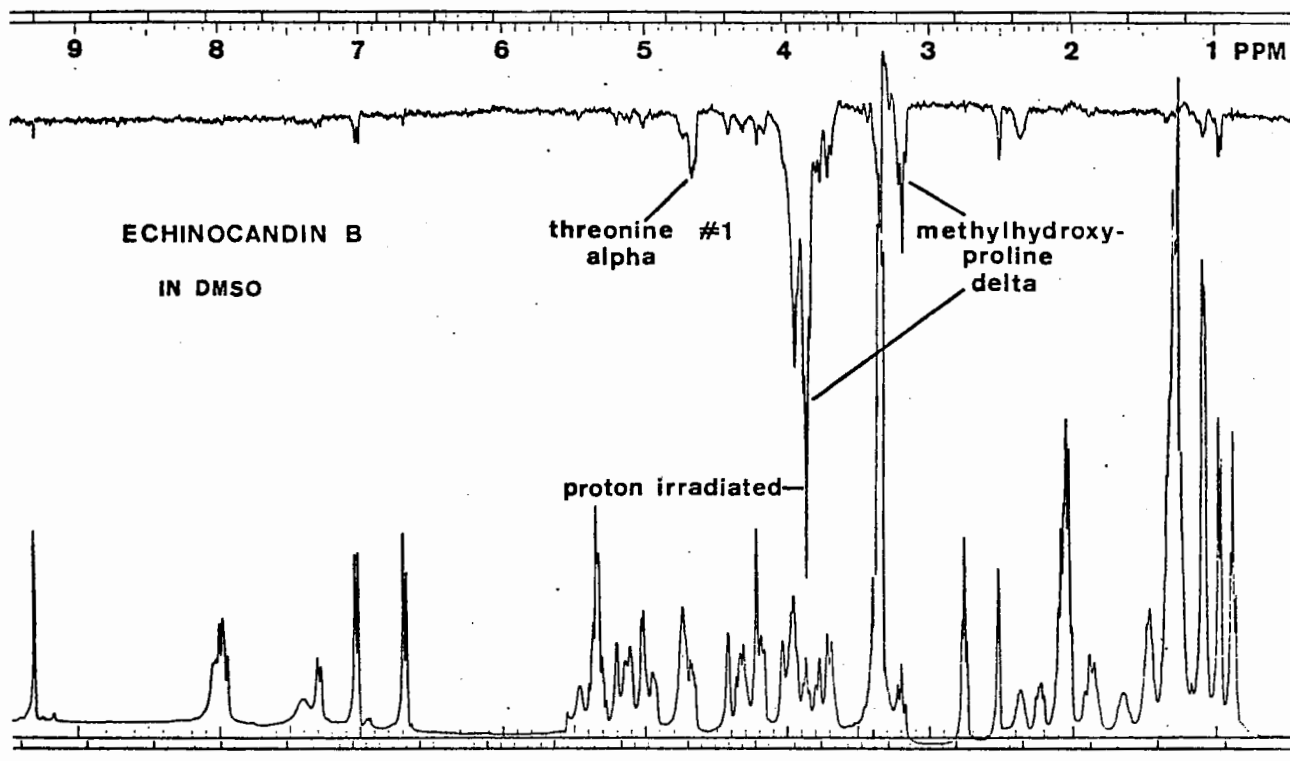
Ann Hunt

Ann Hunt, Ph.D.
Senior Physical Chemist
Physical Chemistry Research

AH:JCW

Attachment

- (1) C. Keller-Juslén, M. Kuhn, H. R. Loosli, T. J. Petcher, H. P. Weber, and A. von Wartburg, *Tetrahedron Lett* **1976**, 4147; R. Traber, C. Keller-Juslén, H. R. Loosli, M. Kuhn, and A. von Wartburg, *Helvetica* **62** (1979), 1252.
- (2) Results to be published.
- (3) M. Kuo and W. A. Gibbons, *J. Biol. Chem.* **254** (1979), 6278; C. R. Jones, C. T. Sikakana, S. Hehir, M. Kuo, and W. A. Gibbons, *Biophys. J.* **24** (1978), 815.



UNIVERSITY OF SOUTHERN CALIFORNIA
UNIVERSITY PARK
LOS ANGELES, CALIFORNIA 90007

DEPARTMENT OF CHEMISTRY
(213) 741-2780

November 6, 1979

Dr. Bernard L. Shapiro
Texas A&M University
College of Science
Department of Chemistry
College Station, Texas 77843

Dear Dr. Shapiro:

^{19}F pH monitor *in vivo*

The spectrum presented here shows the ^{19}F signal from monofluorophosphate, whose pH dependent P-F coupling constant and pH dependent chemical shift are used to monitor the pH inside and outside of respiring yeast cells. A plot of ^{19}F and ^{31}P shifts vs pH is shown below. Extension of this work to real systems of interest is predicated upon synthesis of large batches of γ -ATP-F, and higher-field instrumentation (this is an XL-100 spectrum). The sensitivity advantage of ^{19}F over ^{31}P is important in these systems, and monofluorophosphate and γ -ATP-F are amazingly benign compounds.

Finally, God and the NIH have smiled on USC and we are installing an XL-200 in the Hydrocarbon Institute (Olah, Benson, et al.). This is the ideal instrument for gearing up this work to ΔpH studies in bioenergetics, particularly on cytochrome oxidase in vesicles, a topic we are trying to push right now. γ -ATP-F has its main pH shift in the right pH region for the oxidase system and we are hoping to monitor pH gradients in response to O_2 pulses.

Yours truly,

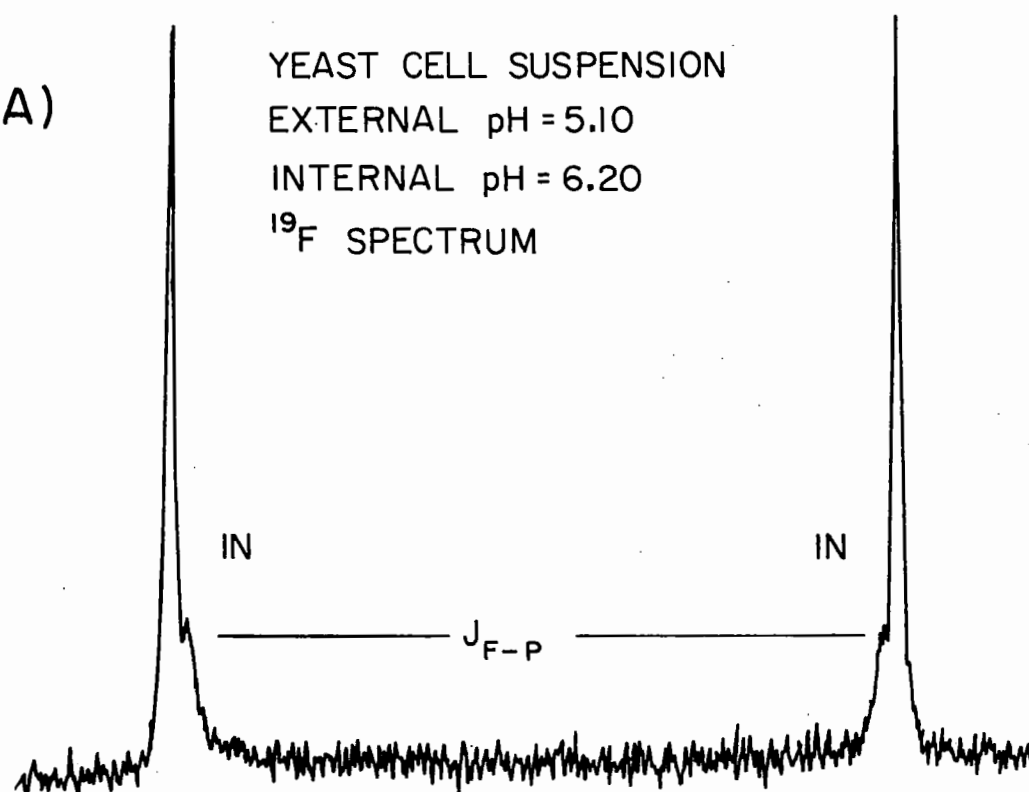
C. Seiter

C.H.A. Seiter
S.G. Angelos

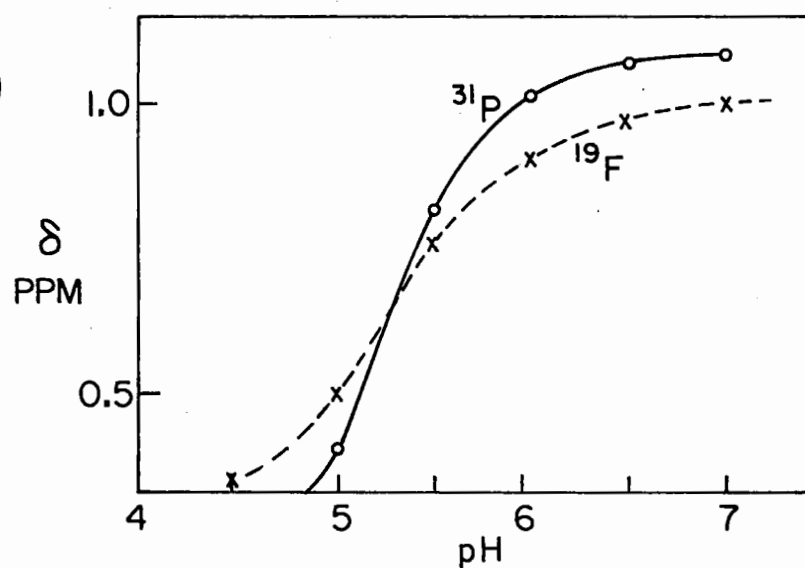
Please credit this to the account of Ken Servis.

CHA:lf

(A)



(B)



- A) MFP SPECTRUM AT 94.1 MHz $J(\text{pH } 6.2 = 557\text{Hz})$, $J(\text{pH } 5.1 = 567\text{Hz})$
 B) ^{31}P AND ^{19}F SHIFTS VS pH, FOR MFP.



INDIANA UNIVERSITY

 DEPARTMENT OF CHEMISTRY
 Chemistry Building
 Bloomington, Indiana 47405
 812-337-5513

November 8, 1979

 Professor Barry L. Shapiro
 Department of Chemistry
 Texas A & M University
 College Station, Texas 77843

Dear Barry:

Carbon-13 NMR of Glycopeptides and
Glycoproteins; Postdoctoral Openings

We have shown recently that natural-abundance ^{13}C NMR spectroscopy can be used to study the structure and dynamic behavior of the carbohydrate residues of aqueous glycoproteins [1]. Furthermore, ^{13}C NMR can be used to study conformational differences, if any, between a glycoprotein and the corresponding unglycosylated protein [2]. As far as we know, there are no reports in the literature of chemical shifts and assignments of the ^{13}C resonances of small glycopeptides. Obviously, this type of information will be very valuable in the interpretation of ^{13}C NMR spectra of glycoproteins. As part of our program of studies of glycoproteins by ^{13}C NMR, we are recording and assigning the ^{13}C NMR spectra of glycosylated amino acids and small glycopeptides. The most tedious aspect is the preparation of the compounds. Dr. Kilian Dill has studied $\text{N}^{\delta 2}$ -(2-acetamido-1,2-dideoxy- β -D-glucopyranosyl)-L-asparagine [β -GlcNAc-Asn] and O^{γ} -(2-acetamido-2-deoxy- β -D-glucopyranosyl)-L-serine [β -GlcNAc-Ser]. The first compound is commercially available; the second one was synthesized by Dr. Dill. More complex glycosylated amino acids (with more than one carbohydrate residue) are now being prepared by Dr. Elisha Berman, by enzymatic cleavage of simple glycoproteins.

We chose β -GlcNAc-Asn for our initial study of ^{13}C chemical shifts of model compounds because it is a common subunit in many glycoproteins. Even though β -GlcNAc-Ser is not normally found in glycoproteins, we chose to initiate our studies of ^{13}C NMR spectra of model compounds with the use of a single type of carbohydrate residue. Our conclusions are readily extrapolated to the commonly occurring α -GalNAc-Ser unit.

Figures 1B and 1C show the region of aliphatic carbons in the natural-abundance proton-decoupled ^{13}C NMR spectra at 67.9 MHz of β -GlcNAc-Asn and β -GlcNAc-Ser, respectively, at pH 6.5. For comparison purposes, fig. 1A shows the corresponding chemical shifts of L-asparagine [3], L-serine [3], and the β -pyranose anomer of

GlcNAc [4]. The assignments of fig. 1B follow by inspection from fig. 1A. The effect of pH was needed to assign C^α and C^β in fig. 1C. Figure 1 has several implications for studies of glycoproteins by ¹³C NMR: (i) The resonances of anomeric carbons which participate in N-glycosidic linkages will not show up in the so-called "anomeric region" of the spectrum (about 90-110 ppm). (ii) The resonances of anomeric carbons which are involved in N-glycosidic linkages will be relatively difficult to identify, because of their proximity to nonanomeric carbon resonances. (iii) The C^β resonance of a serine residue is expected to move about 7 ppm downfield upon formation of the O-glycosidic linkage. In contrast, the chemical shifts of all carbons (even C^γ) of an asparagine residue should change relatively little (≤ 2 ppm) upon formation of the N-glycosidic linkage. Therefore, it should be possible, in principle, to use ¹³C NMR to identify the number of serine and threonine residues (but probably not asparagine residues) which are points of attachment for carbohydrate side chains.

Postdoctoral positions. Postdoctoral research positions are available in my laboratory for studies of proteins, glycoproteins, and carbohydrates in solution. Applicants should have a strong background in biochemistry and/or NMR. Starting salary is \$12,000 to \$13,500 per year.

REFERENCES

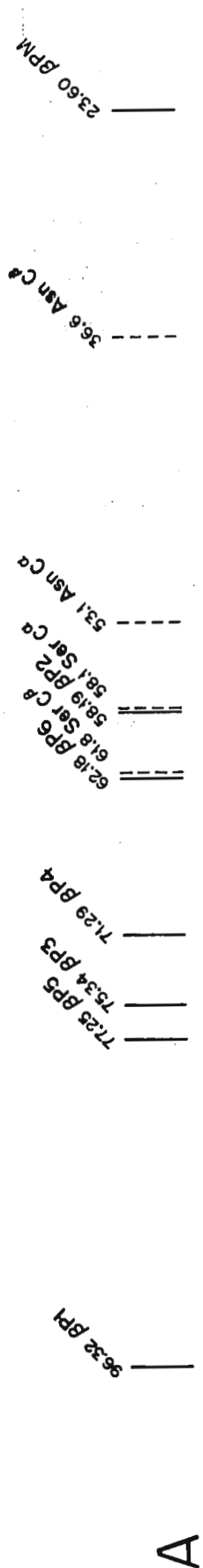
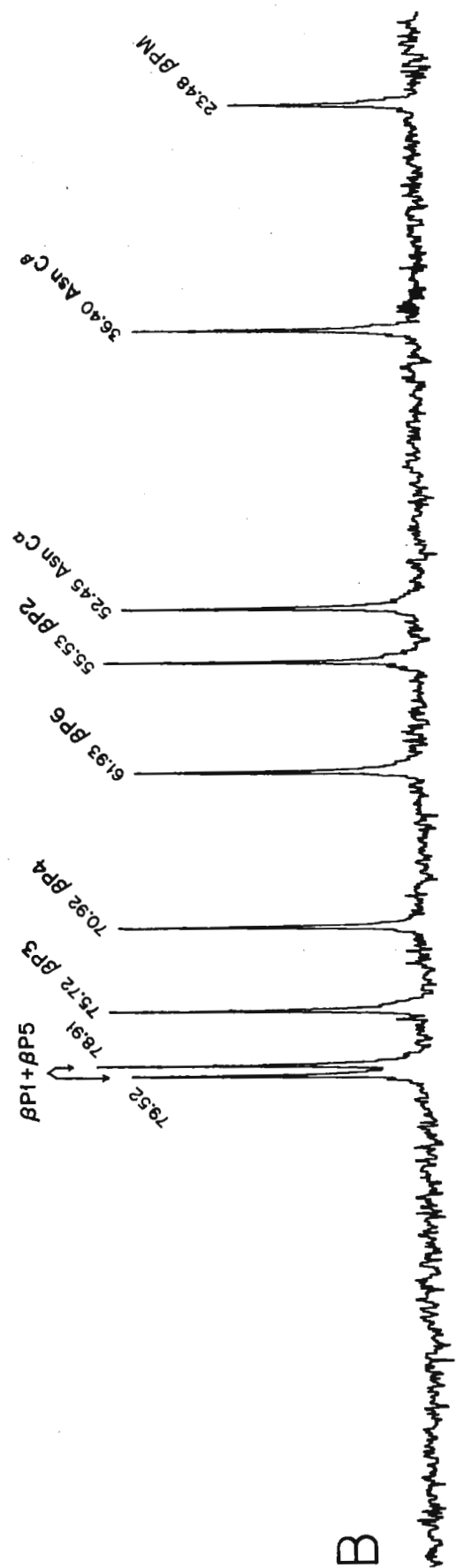
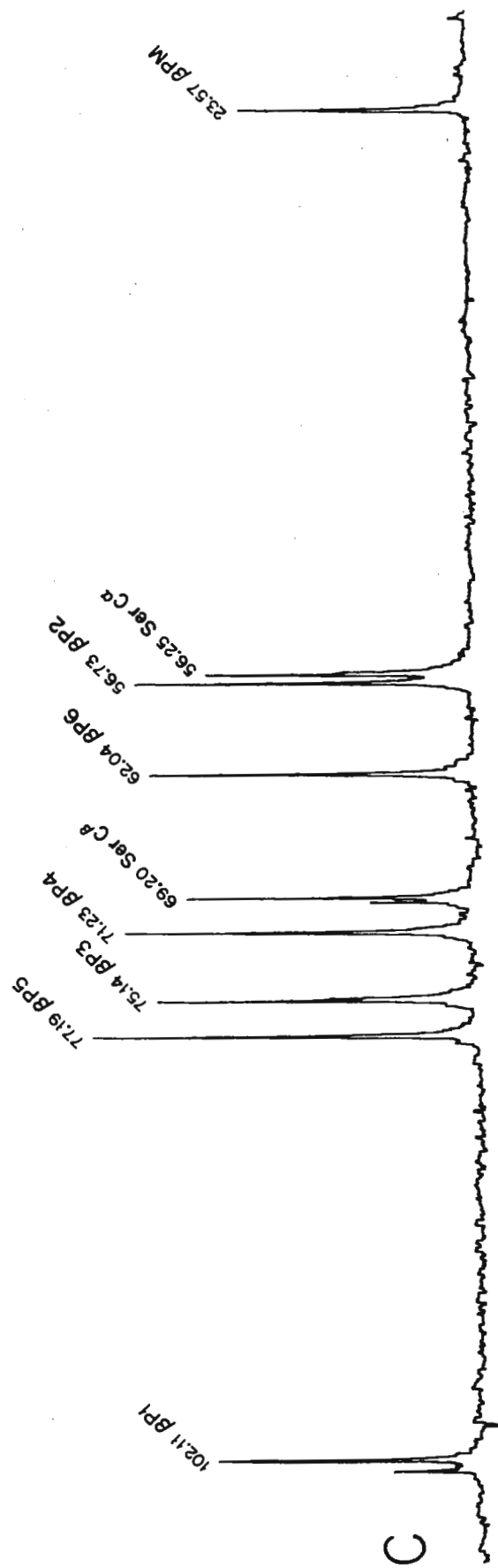
- [1] Dill, K., and Allerhand, A. (1979) J. Biol. Chem. 254, 4524-4531.
- [2] Walters, D. E., and Allerhand, A., submitted.
- [3] Keim, P., Vigna, R. A., Morrow, J. S., Marshall, R. C., and Gurd, F. R. N. (1973) J. Biol. Chem. 248, 7811-7818.
- [4] Bundle, D. R., Jennings, H. J., and Smith, I. C. P. (1973) Can. J. Chem., 51, 3812-3819.

Best regards,



Adam Allerhand
Professor and Chairman

AA/mjs





YORK
UNIVERSITY

FACULTY OF SCIENCE

4700 KEELE STREET, DOWNSVIEW, ONTARIO M3J 1P3

November 22, 1979

Dear Professor Shapiro:

Metal-Hormone Complexes

Despite some fatal problems with an add-on Cambridge Expandicore memory to our CFT-20, we have been struggling on with a study of metal ion-hormone interactions. The hormone TRF (thyrotropin releasing factor) is apparently more active when in the presence of certain metal ions such as zinc, copper or nickel. The latter two are relaxation reagents which cause marked line broadening of carbon-13 and proton nmr resonances near the binding sites. We are looking at the way in which binding is affected by metal ion concentration and pH. Similar studies can be carried out by electroanalytical techniques which monitor proton dissociation but binding to non-protonated carbonyl and other sites cannot be observed in this way. Our results using ^{13}C nmr indicate subtle differences between binding of copper and nickel and a preliminary survey is outlined below.

	pH	copper ion (1:2)	nickel ion (1:1)	(metal:hormone)
	1	no binding		binding to <GLu CO & Pro CO
	1.8	Histidyl N-binding		binding to <GLu, less to Pro
	2.6	Histidyl plus partial Pro		binding to <GLu, less to Pro
	4.0	Histidyl plus Pro ^{tyl} (strongly)		<GLu plus partial Histidyl
	5.0	Histidyl plus Pro ^{tyl} (strongly)		<GLu plus Histidyl strongly
	7.0	Histidyl plus partial Pro		Histidyl plus partial <GLu
	7.5	Histidyl		Histidyl
	10.0	Histidyl plus <GLu		precipitation

The 1:1 copper complex precipitates in acid solution and above pH 7 binding to all sites is apparent. The 1:2 nickel complex qualitatively resembles the 1:1 situation.

I think we can legitimately, this time, truly blame "loss of memory" for our delay in contributing.

Sincerely yours,

C.E. Holloway
Associate Professor

CEH/k1



Oklahoma State University

Department of Chemistry / (405) 624-5920 / Stillwater, Oklahoma 74074

November 13, 1979

Dr. B. L. Shapiro
Department of Chemistry
Texas A & M University
College Station, TEXAS 77843

Dear Barry:

Title: ^{31}P and ^{13}C NMR Analysis of Long-chain, Alkyl-Substituted Phosphine Oxides

We have had occasion to prepare recently some long-chain alkyl-substituted phosphine oxides and to perform a ^{31}P and ^{13}C NMR analysis. These are relatively rare compounds but the patterns appear to follow that predicted from simpler systems. The compounds and data are given below (^{31}P from 85% H_3PO_4 and ^{13}C from TMS):

$(\text{C}_6\text{H}_5)_2\overset{\text{O}}{\underset{ }{\text{P}}}-\overset{\alpha}{\text{CH}_2}-\overset{\beta}{\text{CH}_2}-\overset{\gamma}{\text{CH}_2}-(\text{CH}_2)_5-\overset{3'}{\text{CH}_2}-\overset{2'}{\text{CH}_2}-\overset{1'}{\text{CO}_2\text{H}}$							
(J _{P-C} in Hz)							
^{31}P	C(1')	C(2')	C(3')	(CH ₂) ₅	C(γ)	C(β)	C(α)
34.4	176.9	34.3	24.9	28.9- 29.1	30.7 (14.7)	21.2 (3.6)	29.4 (72.2)
$(\text{C}_6\text{H}_5)_2\overset{\text{O}}{\underset{ }{\text{P}}}-\overset{\alpha}{\text{CH}_2}-\overset{\beta}{\text{CH}_2}-\overset{\gamma}{\text{CH}_2}-(\text{CH}_2)_6-\overset{3'}{\text{CH}_2}-\overset{2'}{\text{CH}_2}-\overset{2'}{\text{CO}_2\text{H}}$							
(J _{P-C} in Hz)							
^{31}P	C(1')	C(2')	C(3')	(CH ₂) ₆	C(γ)	C(β)	C(α)
34.6	176.9	34.7	25.3	29.3- 29.6	31.1 (14.7)	21.6 (3.8)	29.7 (71.5)

All samples were in DCCl_3 as solvent and all spectra were recorded in the PFT mode. We plan to publish part of this work soon. I trust this will serve as our contribution to the important NMR Newsletter. Best regards.

Sincerely yours,

K. D. Berlin

K. D. Berlin
Regents Professor

We cover a lot of ground

geographically and scientifically.

With compounds labeled with Deuterium, Carbon-13, and Nitrogen-15 for use in chemistry, biochemistry, biology, physics and most branches; listing over 1,000 compounds and we custom synthesize new ones daily. Available worldwide from a sales office near you.

May we send you our ground-covering literature?

MERCK & CO., Inc.



ISOTOPES

WEST COAST
P.O. Box 2951
Terminal Annex
Los Angeles, CA 90051
Telephone: (213) 723-9521

EAST COAST & CENTRAL
4545 Oleatha Avenue
St. Louis, MO 63116
Outside state of MO: (800) 325-9034
State of Missouri: (314) 353-7000

CANADA
Merck Sharp & Dohme
Canada Limited/Isotopes
P.O. Box 899
Pointe Claire/Dorval, Quebec
Canada H9R 4P7
Telephone: (514) 697-2823



E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

WILMINGTON, DELAWARE 19898

CENTRAL RESEARCH & DEVELOPMENT DEPARTMENT
EXPERIMENTAL STATION

November 8, 1979

Dr. Bernard L. Shapiro
Department of Chemistry
Texas A and M University
College Station, TX77843

Dear Barry,

Deuterium NMR Study of Titanium-Catalyzed Olefin Metathesis

Deuterium substitution is well established as a tracer technique in studies of reaction mechanisms by proton NMR, the replacement of hydrogen atoms by deuterium being deduced from the decrease in intensity of the corresponding proton resonances. Now that broad-band high resolution NMR spectrometers are readily available, such studies can be extended by direct observation of the deuterium resonances.

Recently, we have investigated the catalysis by the methylene titanium complex, $\text{Cp}_2\text{TiCH}_2\text{AlClMe}_2$, of methylene group exchange between isobutene and methylenecyclohexane using deuterium NMR. Spectra were obtained with a Varian Associates FT80A equipped with a wide-band frequency source and probe, operating at 12.211 MHz for deuterium NMR. A spectral width of 400 Hz was used with an acquisition time of 1 second. 2000 acquisitions gave spectra with adequate signal-to-noise ratios.

The upper set of spectra shown in the figure was obtained from a benzene solution containing the methylene titanium complex with deuteriated methylene and methyl groups, i.e. $\text{Cp}_2\text{TiCD}_2\text{AlCl}(\text{CD}_3)_2$ and isobutene. Immediately after preparation, peaks are visible from the deuteriated methylene and methyl groups of the complex at about 8.5 and 0 ppm, respectively. Two impurity peaks at about 1 ppm and -1 ppm are also visible. On heating, the resonance of the deuteriated methylene group of the complex decreases, and a resonance assigned to a deuteriated methylene group in isobutene appears and grows in intensity.

The lower set of spectra were obtained from a benzene solution of the normal undeuteriated complex and deuteriated isobutene, $\text{CD}_2=\text{CMe}_2$. On heating, the resonance of deuteriated methylene groups in the complex appears, but no resonance corresponding to deuteriated methyl groups in the complex is seen. Similar experiments were carried out using methylene cyclohexane. These experiments support the proposal that the catalyst acts by exchanging methylene groups with the olefins.

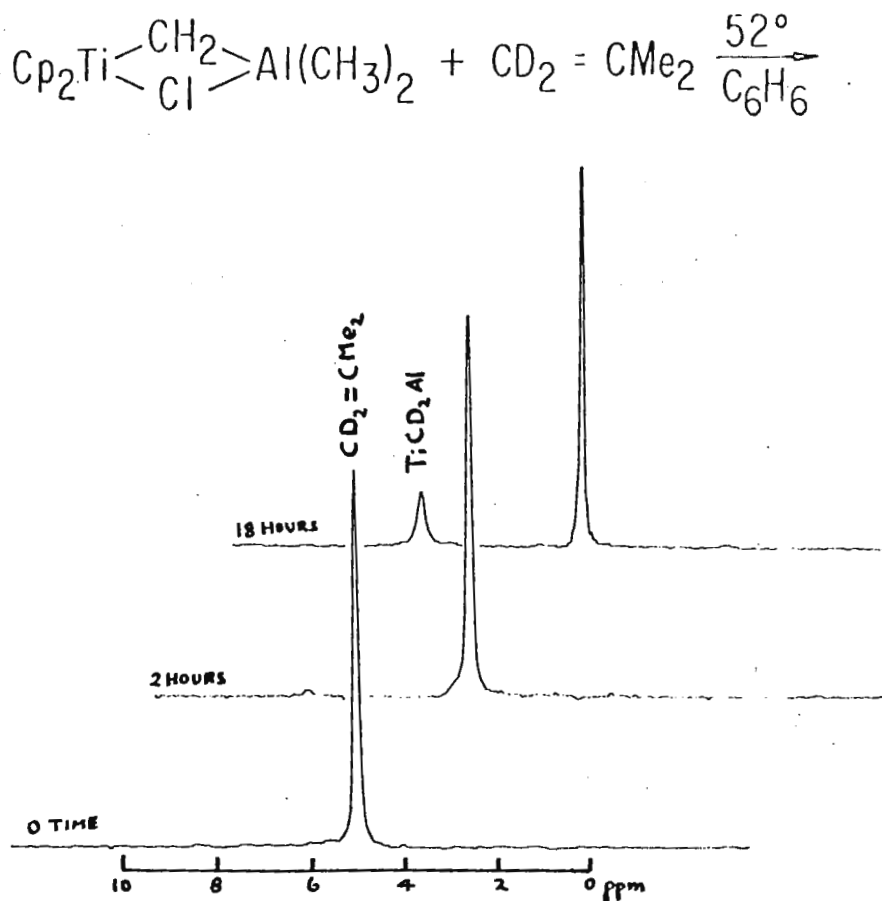
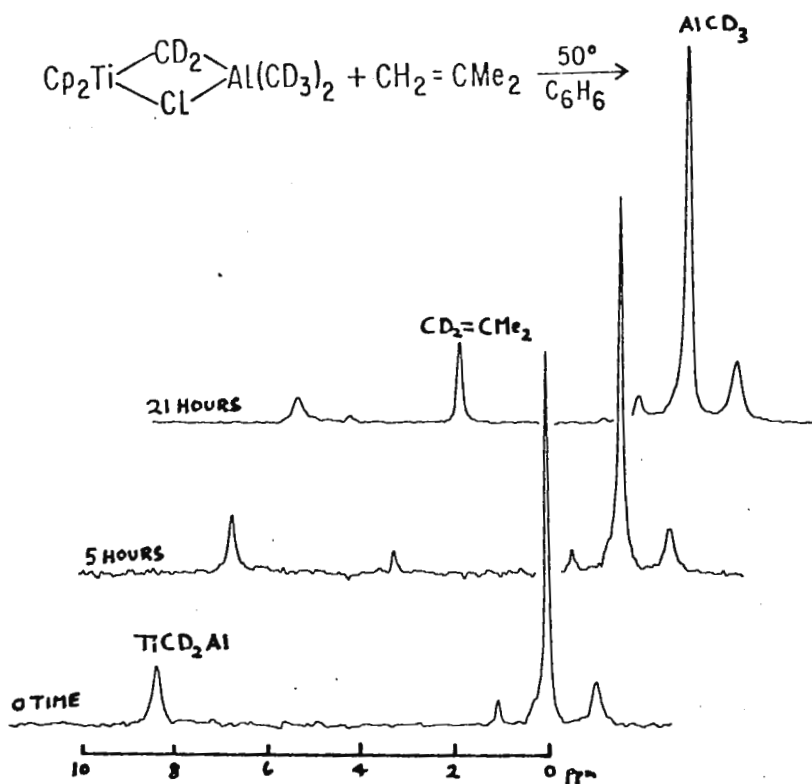
Sincerely,

Denik W. Ovenall

D. W. Ovenall

Fred N. Tebbe

F. N. Tebbe





Laboratorium
für anorganische Chemie
Eidg. Technische Hochschule
Zürich

8006 Zürich, November 23, 1979
Universitätstrasse 6

Professor B. L. Shapiro
Department of Chemistry
Texas A&M University
College Station
Texas 77843

One-Bond Platinum-195 Tin-119 Coupling Constants.

Dear Professor Shapiro,

Our interest in the catalytically active complexes $[\text{PtX}(\text{SnCl}_3)(\text{PEt}_3)_2]$ has prompted us to determine the values $^1J(^{195}\text{Pt}, ^{119}\text{Sn})$. Initial attempts using ^{195}Pt NMR were frustrating in that, although we could observe possible ^{117}Sn and ^{119}Sn signals (both isotopes are ~8 % abundant), these did not seem symmetric about the main band. It develops that the actual one-bond couplings can be so large (see below) that "routine" spectral widths do not suffice to measure a spectrum complete with satellites. Our experience is that 50 KHz spectral widths are satisfactory. The one-bond value of 28,954 Hz for $\text{X} = \text{Cl}$ is an unusually large spin-spin coupling. Please credit this contribution to the account of L. M. Venanzi.

Sincerely

K. A. O. Starzewsky

P. S. Pregosin

K.A.O. Starzewsky & P.S. Pregosin

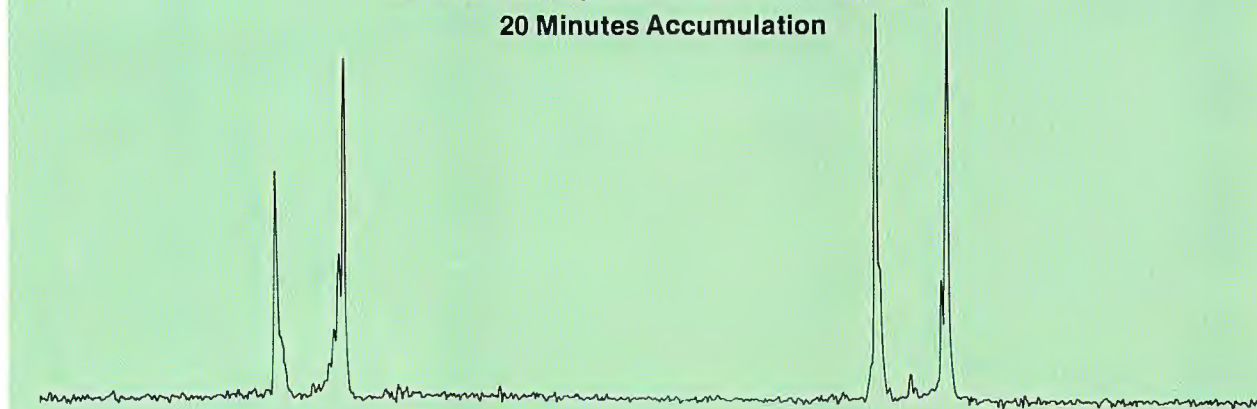
<u>Compound</u>	<u>$^1J(^{195}\text{Pt}, ^{119}\text{Sn}), \text{Hz}$</u>
trans- $[\text{PtCl}(\text{SnCl}_3)(\text{PEt}_3)_2]$	28,954
trans- $[\text{Pt}(\text{SnCl}_3)_2(\text{PEt}_3)_2]$	20,410
trans- $[\text{PtH}(\text{SnCl}_3)(\text{PEt}_3)_2]$	9,067

Suggested Title: One-Bond Platinum-195 Tin-119 Coupling Constants

If you can't observe solids as readily as liquids on your superconducting FT NMR...

...you just don't have an XL-200!

50-MHz NMR Spectrum of Cured Neoprene
20 Minutes Accumulation



¹³C spectrum of cured neoprene with carbon black* in a Kel-F rotor using high-power gated decoupling (400 transients at 3-second intervals). The resolution has been enhanced by a Lorentzian-to-Gaussian transformation to bring out the fine structure. The width of the plot is 10 KHz. *Sample courtesy of E. I. Du Pont de Nemours and Company

With the new ¹³C solid-state accessory for the XL-200, you can spin solid or powdered samples at the magic angle, increase sensitivity using cross-polarization, and achieve efficient line narrowing with strong dipolar decoupling. Yet operation is surprisingly simple! You can introduce and eject the rotor pneumatically without disturbing the probe or the spinning axis adjustment. You monitor the spin rate on the spectrometer's built-in tachometer, just as in liquid-sample experiments. Front panel controls let you adjust optimal cross-polarization and decoupling conditions independently and conveniently.

There are other unique aspects to the XL-200 superconducting FT NMR Spectrometer, such as the data handling and spectrometer control system: a 13-bit ADC, which accommodates stronger signals on each transient; a standard 32K CPU, independent of the acquisition processor and programmed in PASCAL, a high-level, structured language; a built-in interactive 5M-word disk with dual platters; a large, flicker-free raster scan display.

The software, too, is exceptionally sophisticated. It permits multitasking (simultaneous acquisition, processing, printing, etc.) and queuing (automatic sequential execution of requested tasks) on the same or on different NMR experiments. You can also array parameters (up to three variables, including temperature) within a given experiment; generate your own convenient macro-commands;

create your own special or general-purpose pulse sequences in a simple, English-like code; even do your own computer programming in PASCAL.

Then there's the matter of the XL-200's broadband accessory which, with only a single probe for liquid samples, enables you to observe a host of nuclei (including ¹³C) between 20 and 81 MHz. And there's the remarkable low-loss dewar system, which operates over three months on only 25 liters of liquid helium.

The XL-200 is in a class by itself—with a price tag and an operating economy that belie its advanced design.





Your reference

Your letter of

Our reference 79/508 MH/jw

Date November 22, 1979

Enclosures -

Professor B.L. Shapiro
Department of Chemistry
Texas A. & M. University
College Station, Texas 77843

U.S.A.

Subject NMR and flowing water

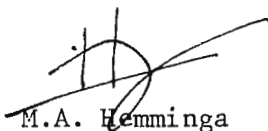
Dear Professor Shapiro,

For several years we have been working in our laboratory on a project dealing with the study of water flow with NMR. Since NMR is a non-disturbing technique, it is in principle very useful to study, for example, water transport in plant stems. In most biological systems in which water flows, also stationary water is present and the big problem of the application of NMR in this field is to discriminate between the two fractions.

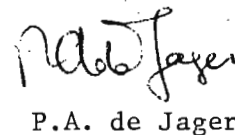
Recently, we have developed a pulsed NMR method that makes possible the measurement of flow velocities of flowing water in the presence of stationary water (1,2). The method employs a regular sequence of identical rf pulses and a linear gradient in the static magnetic field in the direction of flow.

At certain values of the field gradient the transient NMR signals of flowing water have a maximum. The time at which this maximum appears is inversely proportional to the flow velocity. In this way flow velocities can be measured in capillary systems in the region 1 to 50 mm/sec.

Yours sincerely,



M.A. Hemminga



P.A. de Jager

(Please credit this contribution to the account of professor T.J.Schaafsma)

1. P.A. de Jager, M.A. Hemminga and A. Sonneveld, *Rev. Sci. Instr.* 49 (1978) 1217.
2. M.A. Hemminga and P.A. de Jager, *J. Magnetic Resonance* 36 (1979) to appear.



UNIVERSITY COLLEGE OF SWANSEA

Department of Chemistry

SINGLETON PARK SWANSEA SA2 8PP
UNITED KINGDOM
TEL SWANSEA (0792) 25678

J. H. Purnell M.A., Ph.D., Sc.D., C.Chem., F.R.I.C.
Professor of Physical Chemistry and
Head of Department.

A. Pelter Ph.D., D.Sc., D.C.C., C.Chem., F.R.I.C.
Professor of Organic Chemistry.

J. H. Beynon, D.Sc., C. Chem., F.Inst.P., F.R.I.C.
F.R.S.,
Royal Society Research Professor.

Our Ref. JMW/CDP.

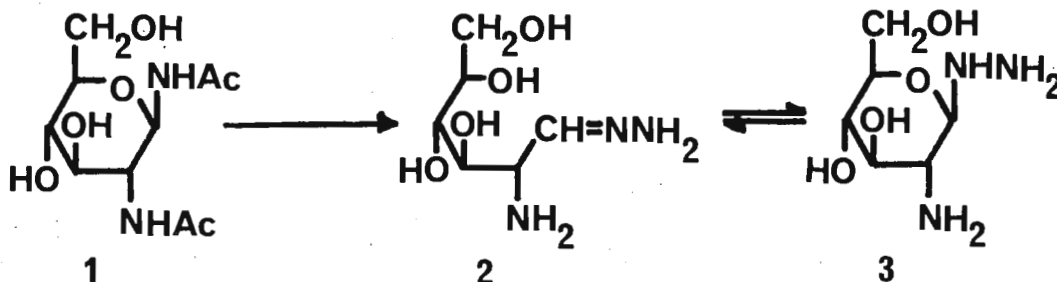
Professor Bernard L. Shapiro,
Department of Chemistry,
Texas A & M University,
College of Science,
College Station,
Texas 77843, U.S.A.

12th November, 1979.

¹³C n.m.r. of Sugar hydrazones in hydrazine; broad
peaks in spectra of alkaloid glycosides.

Dear Professor Shapiro,

We have found ¹³C n.m.r. measurements particularly helpful in a study of the products of hydrazinolysis of various 1-N-acyl derivatives of 2-acetamido-2-deoxy-β-D-glucopyranosylamine e.g. (1).

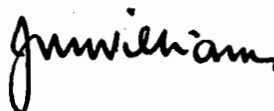


These reactions, which are models for the hydrazinolysis of glycoproteins and glycopeptides containing GlcNAc-Asn linkages (ref. 1), are carried out with anhydrous hydrazine in sealed tubes at 100-105°. A complicating factor in studying the products is the tautomerism which they undergo in solution, and it was informative to compare the spectra of the products in hydrazine and D₂O. In hydrazine the hydrazone product existed predominantly as the acyclic tautomer (2, C-1 at 149.0 p.p.m., using Me of MeCONHNH₂ as reference peak) whereas in D₂O the cyclic tautomer (3, C-1 at 93.9 p.p.m., T.S.P. reference) predominated slightly. The spectra also enabled us to identify a monoamide (Me at 24.8 p.p.m.), the product of incomplete reaction. It would be very convenient to follow these reactions overnight by ¹³C measurements but I have been reluctant to try such a hazardous experiment in a sealed n.m.r. tube. In this context I would be very interested to learn of your readers' experiences in studying reactions in sealed n.m.r. tubes at elevated temperatures.

Finally, I would like to refer to the ^{13}C spectra of some alkaloid glycosides which have been isolated from plants. Proton-noise-decoupled spectra which we have measured for Professor A.H. Jackson of University College, Cardiff, contained several broad peaks (W_h 15-20Hz) as well as some sharp peaks. All the monosaccharide peaks and some of the aglycone peaks were broad. The most likely explanation, namely contamination of the glycosides with a paramagnetic compound, could presumably be tested by attempting to remove paramagnetic ions with H_2S or EDTA (cf. ref. 2). We would like to know whether other readers have made similar observations.

I hope this contribution will sustain our subscription which I have taken over from Claude Haigh.

Yours sincerely,



J.M. Williams.

References

1. M. Fukuda, T. Kondo and T. Osawa, J. Biochem. (Tokyo), 80, 1223, 1976.
2. F. Hasan, R. Deslauriers, and I.C.P. Smith, TAMU NMR Newsletter, 204, 35, 1975.



QUEEN MARY COLLEGE

UNIVERSITY OF LONDON

DEPARTMENT OF CHEMISTRY

Professor K.W.Sykes, MA,BSc,DPhil. (Head of Department)
 Professor D.C.Bradley, BSc,PhD,DSc,ARIC.
 Professor R.Bonnett, BSc,PhD,DSc.

MILE END ROAD
 LONDON E1 4NS
 Tel. 01-980 4811

Professor B.L. Shapiro,
 Department of Chemistry,
 Texas A&M University,
 College Station,
 TX 77843,
 U.S.A.

15th November, 1979

Dear Professor Shapiro,

Peptide Proton Exchange by ^{15}N N.m.r.

Following on our ^{15}N study¹ of the detection of the one N-H bond involved in an intramolecular hydrogen bond in the cyclic peptide viomycin in aqueous solution we have extended the method to the cyclic peptide gramicidin S in non-aqueous solution. The method hinges on the observation of the relative lability of peptide protons as monitored by the resistance to collapse of the one bond ^{15}N - ^1H splitting in the ^{15}N spectrum. One can vary this ^{15}N - ^1H splitting by varying the ^1H frequency offset when using ^1H off-resonance decoupling. Gramicidin S has the primary structure (D-Phe-L-Pro-L-Val-L-Orn-L-Leu)₂ and the Val and Leu NH groups are shielded from the solvent (intramolecular H-bonding) while the Phe and Orn NH groups are exposed to the solvent. It is known² that the relative ease of exchange of the peptide protons is Phe > Orn >> Leu, Val.

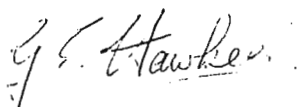
The accompanying figure shows the high frequency region of the 18.24 MHz (WH-180) natural abundance ^{15}N n.m.r. spectra of gramicidin S, 140 mM in DMSO:MeOH (3:1) with added base to promote peptide proton exchange. Chemical shifts are to high frequency of the $^{15}\text{NH}_4^+$ reference. The base used was 40% aqueous $\text{Bu}_4\text{N}^+\text{OH}^-$ (ca. 75 mg/ml of gramicidin solution). Figure A shows the ^1H broad band decoupled ^{15}N spectrum with assignments made by specific ^{15}N -(^1H) double resonance experiments. B is with ^1H single frequency irradiation at the Val NH resonance and C,D,E with ^1H single frequency irradiation to low frequency of the Val NH resonance by 0.56, 3.33 and 5.56 p.p.m. respectively.

The Val and Leu ^{15}N resonances are clean doublets - slow proton exchange. Since the Phe and Orn ^1H resonances are to high frequency of the Val ^1H resonance we might expect doublets for these two ^{15}N resonances also. However, in B it is clear that the Phe ^{15}N resonance is completely "exchanged-decoupled" while the Orn ^{15}N resonance is a broadened singlet (incomplete "exchange-decoupling"). As the ^1H irradiation is moved to lower frequency (B \rightarrow E) then the ^{15}N resonances for Phe and Orn move progressively towards the slow exchange situation.

Thus these ^{15}N spectra are in accord with the previous ^2H data on the exchange rates Phe > Orn >> Leu, Val.

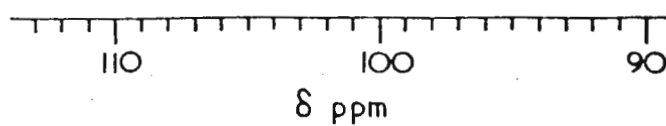
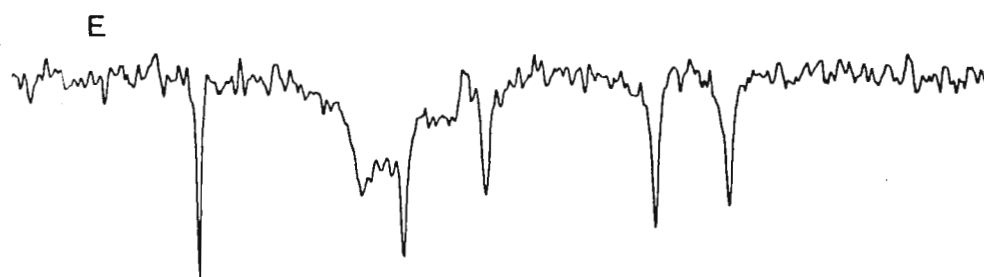
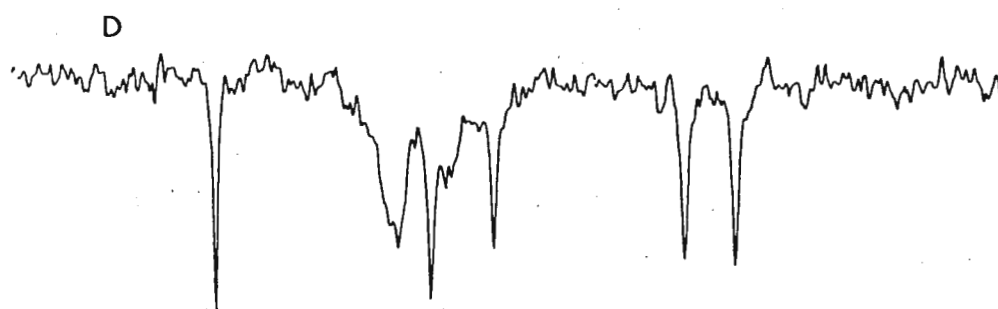
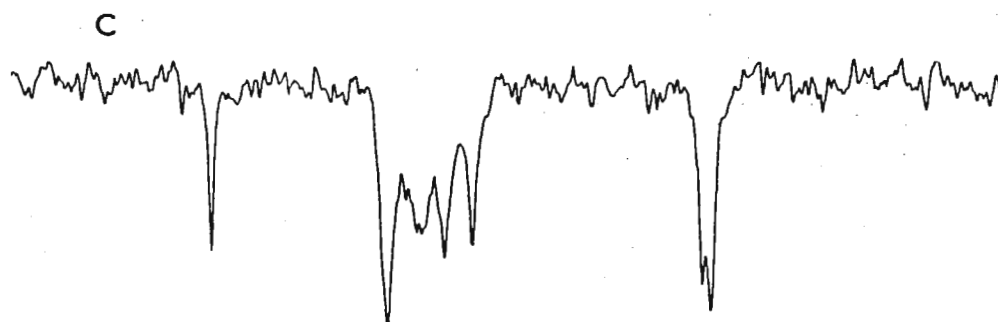
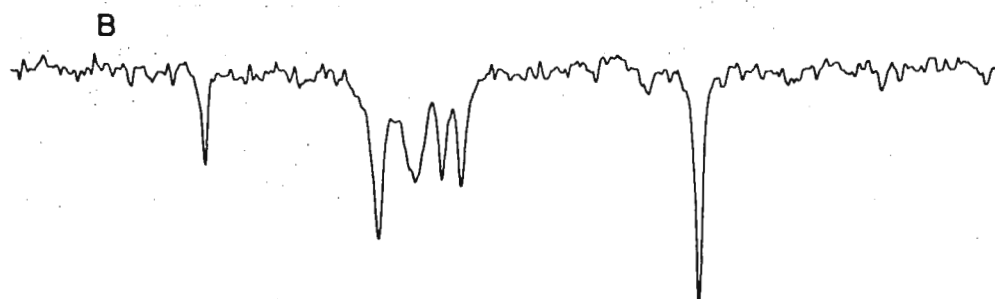
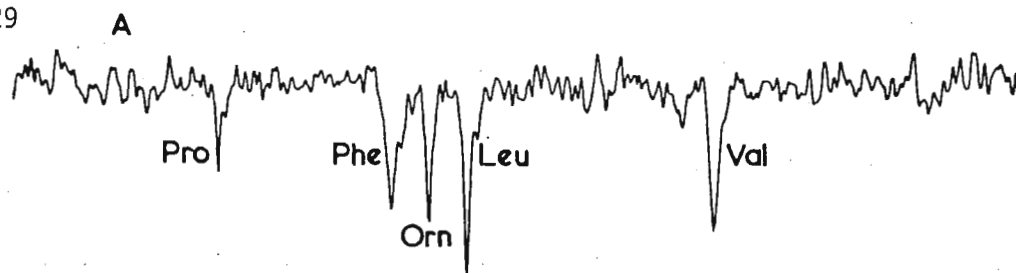
Please credit this contribution to Ed Randall's account.

Yours sincerely,



Dr. G.E. Hawkes

1. G.E. Hawkes, E.W. Randall, W.E. Hull, D. Gattegno and F. Conti, Biochemistry, (1978), 17, 3986.
2. A. Stern, W.A. Gibbons and L.C. Craig, Proc. Nat. Acad. Sci. U.S.A. (1968), 61, 734.

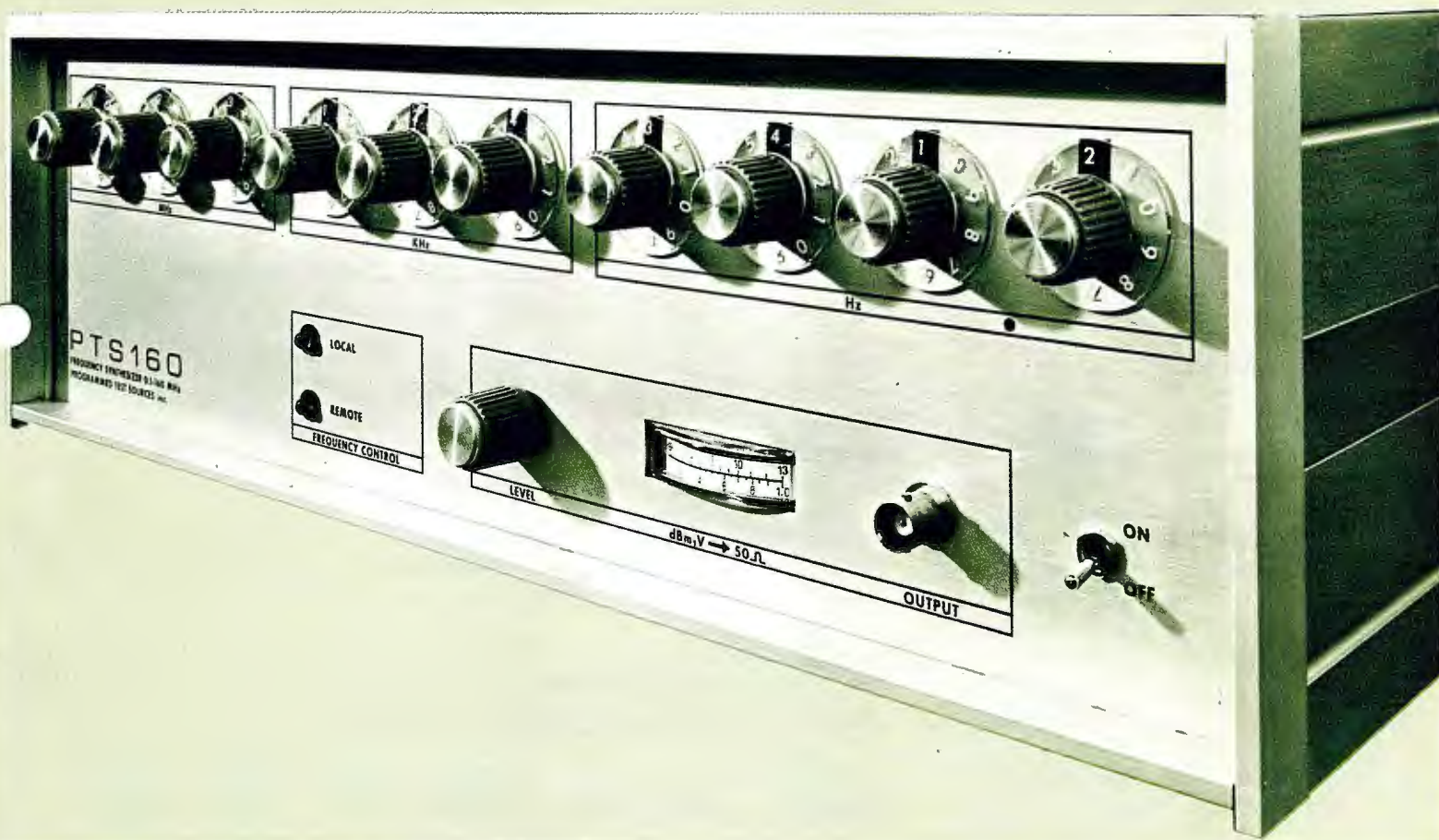


160 MHz

PTS
FREQUENCY SYNTHESIZERS

HIGH PERFORMANCE

DIRECT SYNTHESIS



PTS 160 FREQUENCY SYNTHESIZER

- 0.1 MHz to 160 MHz
- +3 to +13dBm output
- choice of resolution
- low phase noise
- fast switching, 5-20 micro-sec.
- fully programmable, BCD or IEEE 488 BUS
- modular flexibility, remote-only versions
- low power consumption, high reliability

The PTS 160 is a generator of precision frequencies. It transfers the accuracy and stability of a frequency standard (built-in or external) to any output frequency between .1 MHz and 160 MHz. Steps as fine as 0.1 Hz are available and all functions are remotely programmable.

The PTS 160 is a direct frequency synthesizer of novel design providing high performance for many demanding applications. With its low spurious outputs, fast switching, low phase noise and wide choice of resolution (finest step), it is suited for a range

of uses from NMR to communications or ATE.

This new system of synthesis has drastically cut complexity and parts count. The attendant reduction of primary power input and dissipation (less than 50% of that of competitive designs) is a major factor in the reliability which is further enhanced by the use of ceramic ICs, all metal-can transistors and a packaging system maximizing mechanical integrity and stability while keeping weight low. For ease of service most modules are identical and of plug-in design.

SPECIFICATIONS

FREQUENCY	Range:	0.1MHz to 160 MHz						
	Resolution:	0.1Hz to 100KHz steps (optional in decades)						
	Control:	Local by 10-position switches. Remote by TTL-BCD, 1248, buffered par. entry or by IEEE 488 BUS. (option)						
	Switching Time:	20 micro-sec. (within 0.1rad at new frequency)						
OUTPUT	Level:	+ 3 to + 13dBm, (1V) into 50 ohms, metered in dBm and volt						
	Flatness:	± 0.5dB						
	Impedance:	50 ohms						
	Control:	Manual by F/P-control, remote by voltage, (+ 0.63 to + 2.00V)						
	Settling Time:	20 micro-sec.						
SPURIOUS OUTPUT	Discrete:	—75dB						
	Harmonics:	—35dB at full output, (—40dB at lower level)						
	Phase Noise:	—63dBc, (0.5Hz to 15KHz), incl. effects of int. standard						
	L (1Hz):	100Hz/105dBc; 1KHz/115dBc; 10KHz/123dBc; 100KHz/130dBc.						
	Noise Floor:	—135dBc/Hz						
FREQUENCY STANDARD	Internal:	3 x 10 ⁻⁹ /day or 1 x 10 ⁻⁸ /day (optional)						
	External Drive:	5.000 or 10.000MHz, 0.5V into 300 ohms						
	Aux. Output	10.000MHz, 0.4V into 50 ohms						
GENERAL	Oper. Ambient:	0 to 55°C, 95% R.H.						
	Power:	105-125V, 50-400Hz, 45 Watts						
	Dimensions/Weight:	19 x 5¼ x 18" Relay rack or bench cabinet, 35 lbs.						
PRICES (domestic)	Resolution:	100KHz	10KHz	1KHz	100Hz	10Hz	1Hz	0.1Hz
	\$	3,250.—	3,450.—	3,650.—	3,850.—	4,050.—	4,250.—	4,450.—
	Freq. Standards: (Option)	3 x 10 ⁻⁹ /day, \$450.— (oven)			1 x 10 ⁻⁸ /day, \$200.— (TCXO)			
	IEEE 488 Interface:	\$650.— (This option replaces standard parallel entry BCD interface				Delete Front Panel Controls: —\$200.—		

PROGRAMMED TEST SOURCES, inc.

69 HAYWARD ROAD

• ACTON, MA 01720

• (617) 263-6467

GESELLSCHAFT ZUR FÖRDERUNG DER SPEKTROCHEMIE
UND ANGEWANDTEN SPEKTROSKOPIE E. V.
INSTITUT FÜR SPEKTROCHEMIE

255-32

From:

Dr. R. Gerhards c/o

Postanschrift: Institut für Spektrochemie, Postfach 778, 4600 Dortmund 1

Professor B.L. Shapiro

Chemistry Department

Texas A & M University

College Station, Texas 77843 / USA

Bunsen-Kirchhoff-Straße 11
(Abzweig Ardeystraße)
Fernruf (0231) 129001-04

Ihre Zeichen

Ihre Nachricht vom

Unsere Zeichen

Ger/Mas.

4600 DORTMUND 1, 16.11.1979

Betreff: Title: 'The Importance of Phase Correction for Quantitative
¹³C-NMR-Spectroscopy of High- and Non-Boiling Mineral Oil Samples'

Dear Professor Shapiro,

Principally, NMR-spectroscopy is the only spectroscopic method to get quantitative informations on mixtures without knowing the actual components in the mixture. Theoretically, the intensities of the signals measured with special equipment are directly proportional to the concentration of the substance.

In practice, deviations from this linear relation are observed. Signal distortions that are observed in ¹³C-NMR-spectroscopy are caused on one hand, by attributes of the substances (different T₁ and NOE-factors) and on the other hand by the hard- and software of the equipment.

The first mentioned problems can be overcome by special experimental procedures like inverse gated decoupling, addition of relaxation reagents and by prolonging the pulse repetition time (1,2,3,4). From the hard- and software which has a bearing on the detected signal intensities such as linearity of the transmitter/receiver-combination, the number of memory addresses to store the data, the procedures to correct base-line and phase and to carry out the integration, the phase correction is very problematic for samples where broad overlapped bands are detected as in spectra of mineral oil and coal products.

The example (¹³C-NMR spectra of a distillation residue of a crude oil), stated in the figure shows no sharp line in the aromatic spectral region; therefore, no indicator is present to correct the phase in the usual interactive way.

To show the influence of the phase correction for this special sample, the relation between aliphatic and double-bonded carbons determined by the quotient of the corresponding integrals in the table, is given as function of the phase correction constants. The numbers in the spectra of the figure correspond to the numbers in the table.

No.	P _o	P ₁	C _{al} /C _{ar}
1	182	120	1.49
2	180	100	1.50
3	179	70	1.65
4	177	50	1.87
5	175	20	2.21
6	171	0	2.60
7	169	-20	3.04
8	163	-50	3.33
9	162	-70	3.33

Table: Dependence of quantitative ¹³C-NMR-data on phase-correction constants of a non-boiling mineral oil sample

Although hardly any dispersive portions can be detected with the naked eye even for the extreme phase-correction constants, the calculated relations between aliphatic and double-bonded carbons vary approximately by one factor of 2.

To overcome this unsatisfying state, two possibilities exist. One is, to develop an automatic phase correction procedure independent of the operator of the NMR-spectrometer.

An easier method seems to be the following: By addition substances to the sample that show sharp signals at the edges of the spectral regions of interest (CS₂, 192.8 ppm, CDCl₃ 76.9 ppm, TMS 0 ppm), indicators for the usual phase-correction procedures will appear. But if the phase of these signals is correct, all signals in between the hereby defined spectral region must have the correct phase, too. Consequently, the integrals can be determined with a reproducibility of about 5% for spectra such as those stated in the figure.

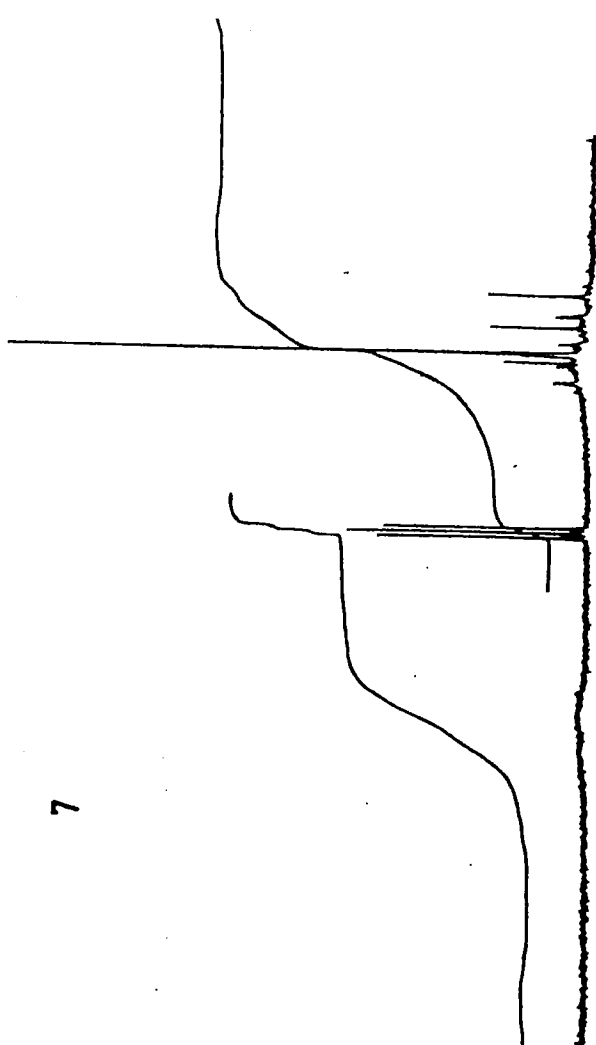
Yours sincerely,

R. Glaser

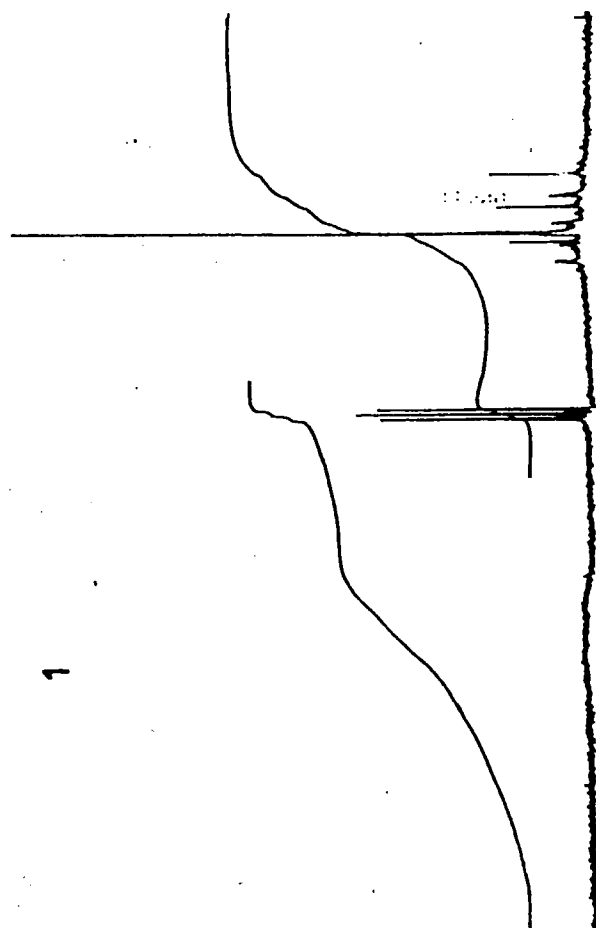
P.S. In the event that there is anybody who has recently developed or intends to develop an automatic phase-correction procedure capable of handling not just sharp signals, I would be very interested to contact that person.

Literature:

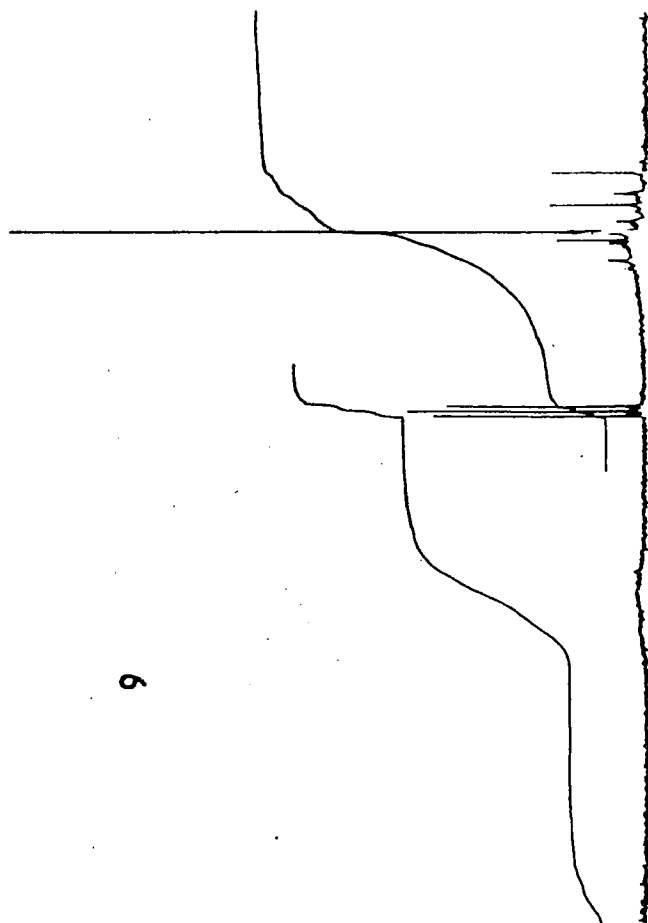
1. K.F. Kuhlmann, D.M. Grant, J. Chem. Phys. 55, 1998 (1971)
2. D.F.S. Natusch, J. Amer. Chem. Soc., 93, 2566 (1971)
3. R.J. Pugmire, D.M. Grant, K.W. Zin, L.L. Anderson, A.G. Obland, R.E. Wood, Fuel, 36, 295 (1977)
4. B. Thiault, M. Mersseman, Org. Magn. Resonance, 8, 28 (1976)



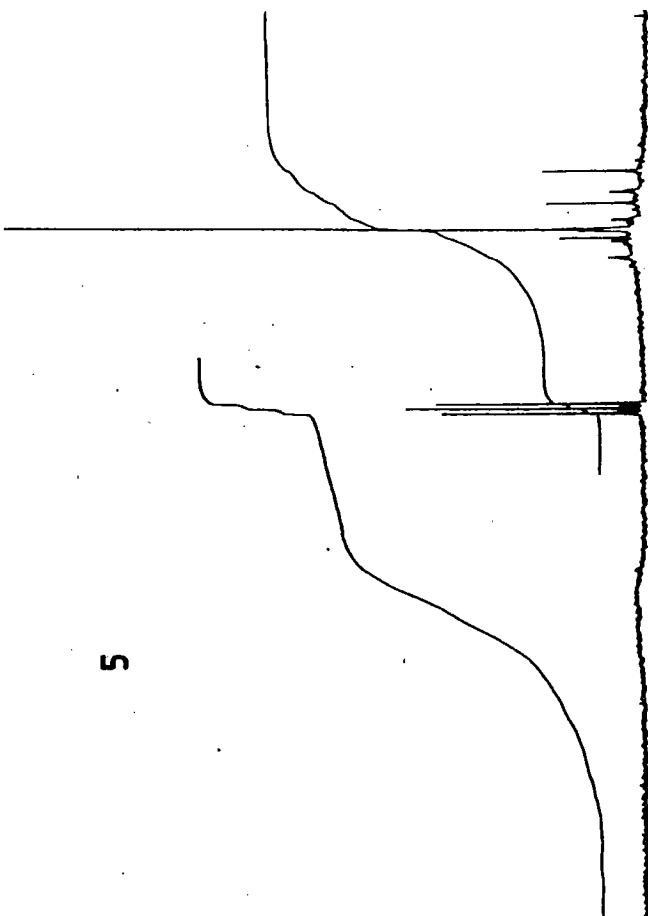
7



1



9



5

Départements :

Spectrométries de Résonance Magnétique
 Spectrométrie Infra-Rouge Fourier
 Polarographie
 Aimants & alimentations stabilisées
 Mesures de Susceptibilité magnétique
 Recherche Océanographique

Professor B.L. SHAPIRO
 Dpt of Chemistry
 Texas A & M University

COLLEGE STATION, Texas 77843

USA

N./Réf. 79 11 427 CB/MCH
 V./Réf.

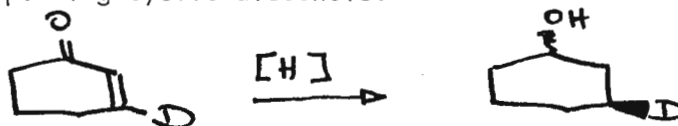
Wissembourg, le November 5, 1979

Think Deuterium !

Deuterium should no longer be considered as a "locking" isotope, specially since high field instrument are routinely available.

We recently had to solve in connexion with Prof. J.C. GRAMAIN, ERA n° 392, from U. of Clermont-Ferrand a rather tricky problem.

The microbiological reduction (from *Beauveria Sulfurescens*) of deuterio 3 cyclohexenone leads to the deuterio 3 S cyclohexanone together with the corresponding cyclic alcohols.



It was rather difficult, if impossible, to check the axial-equatorial ratio of the two alcohols from proton NMR (WM 250 spectrometer, spectrum 1). By using the lock channel of the proton probehead and pulsing, through the WM 250 multinuclear electronics, at 38,39 MHz, a simple and clearcut deuterium spectrum was recorded (spectrum 2), this overnight accumulation exemplifying the extreme stability of the WM 250 running without lock.

Axial and equatorial deuterium are easily assigned from their coupling with protons.

Interestingly enough is the 0.45 ppm difference between these two deuterons. Then by using the proton observing coil to broad-band decouple the protons, one gets a nice 50/50 ratio for the two isomers (spectrum 3) showing that the deuterium in the 3 position does not affect the stereochemistry of the reduction of the carbonyl group.

A full account of the chemical aspect of this work will be published soon.

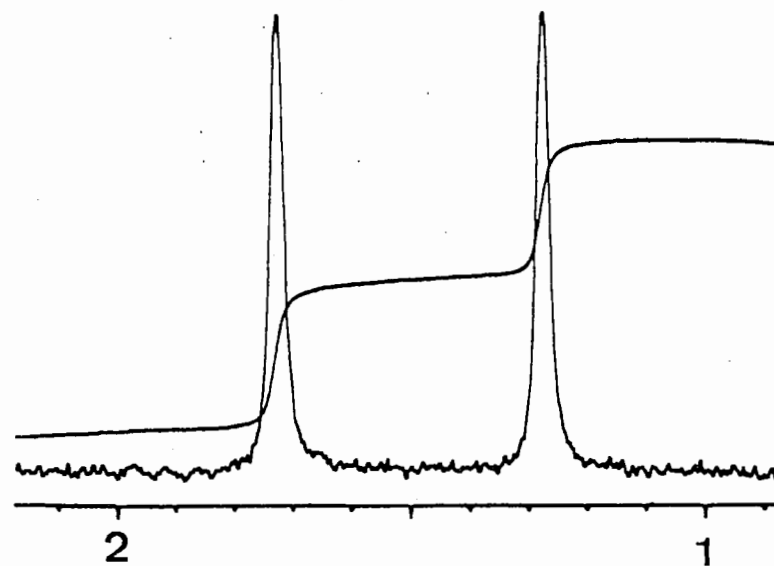
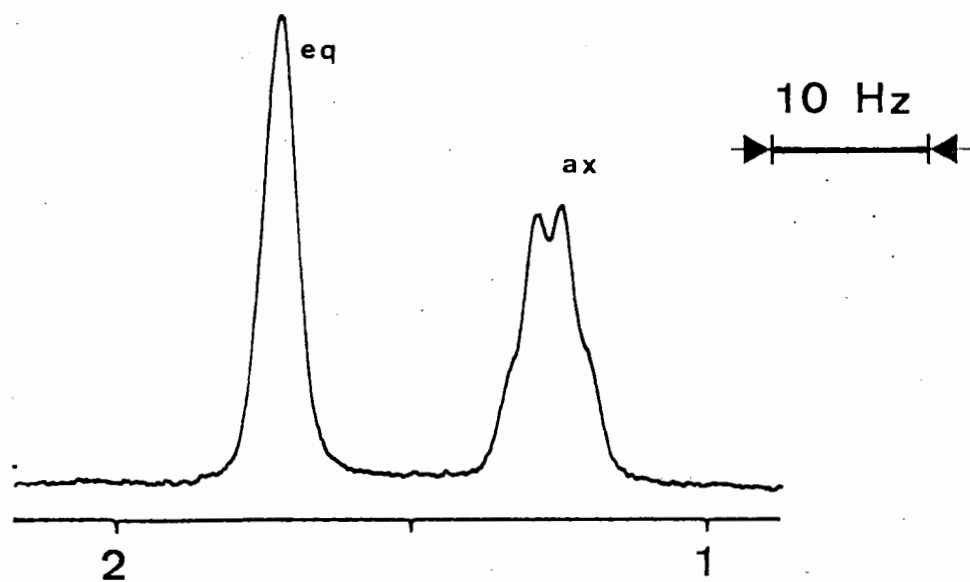
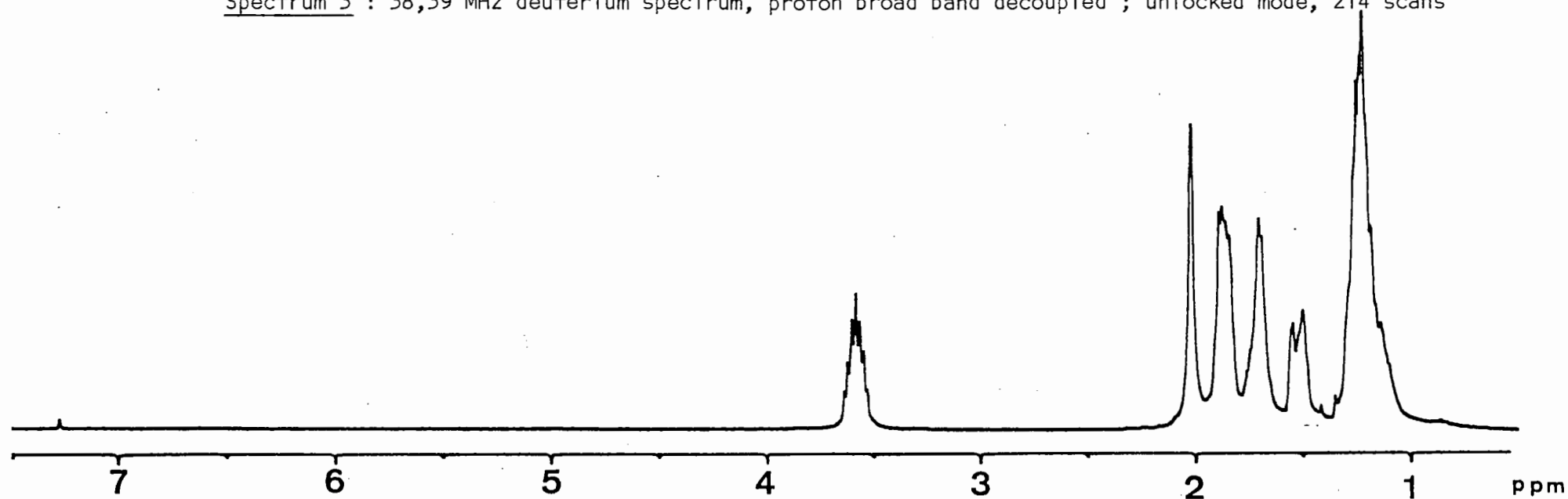
Sincerely yours,

Christian BREVARD

Spectrum 1 : 250 MHz proton spectrum of 3 d_{ax}cyclohexanol + 3 d_{eq} cyclohexanol mixture

Spectrum 2 : 38,39 MHz deuterium spectrum of same mixture (5 800 scans), overnight run unlocked

Spectrum 3 : 38,39 MHz deuterium spectrum, proton broad band decoupled ; unlocked mode, 214 scans



MERCK INSTITUTE

FOR THERAPEUTIC RESEARCH

RAHWAY, NEW JERSEY 07065

BYRON H. ARISON, PH.D.

LABORATORY

DEPARTMENT OF BIOCHEMISTRY

TELEPHONE (201) 574-6746

(201) 574-5394

Dr. Barry L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77843

Dear Barry: Title: Direct Observation of
 Peptide Protons in CD₃OD and D₂O

Direct observation of peptide protons in aqueous solution has been an on-going problem particularly with FT where dynamic range limitations dictate the use of D₂O.

We wish to report that we can detect the amide protons in D₂O solutions containing about 5% H₂O. The heretical idea of deliberately degrading the D content of the solvent came from the observation of weak NH signals in the relatively concentrated CD₃OD solution of an oligopeptide (ca. 30 mgs/0.35 ml or ca. 0.1 M) which had been used for ¹³C studies (Figure 1). The relative areas of the residual active hydrogens were about 5% of stoichiometry which corresponded roughly to the calculated D/H ratio in the solvent active hydrogen pool. The suspicion that the spectrum reflected an equilibrium rather than a kinetic condition was confirmed by showing that the same area ratios were reached 15 minutes after dissolution of the peptide. (The spectrum in Figure 1 was obtained 10 days after solution preparation.) Since similar results in CD₃OD have now been obtained on a number of peptides in the 0.02-0.05 M range, there was every reason to believe that the phenomenon was general. This view thus led to attempts to duplicate these findings in aqueous systems. The results on the pituitary hormone somatostatin in 95% D₂O/5% H₂O (Figure 2) indicate that most and possibly all of the 14 NH signals have been visualized.

Despite the weak intensities it has proved to be no great chore to assign or associate each peptide proton in our oligopeptides with the corresponding α -hydrogen via double irradiation experiments. There is, in fact, a virtue in obtaining spectra in which the amide proton signals are kept at low levels since the complication of NH-CH couplings are not evident in the α -hydrogen resonances.

Sincerely yours,



Byron H. Arison

/oah

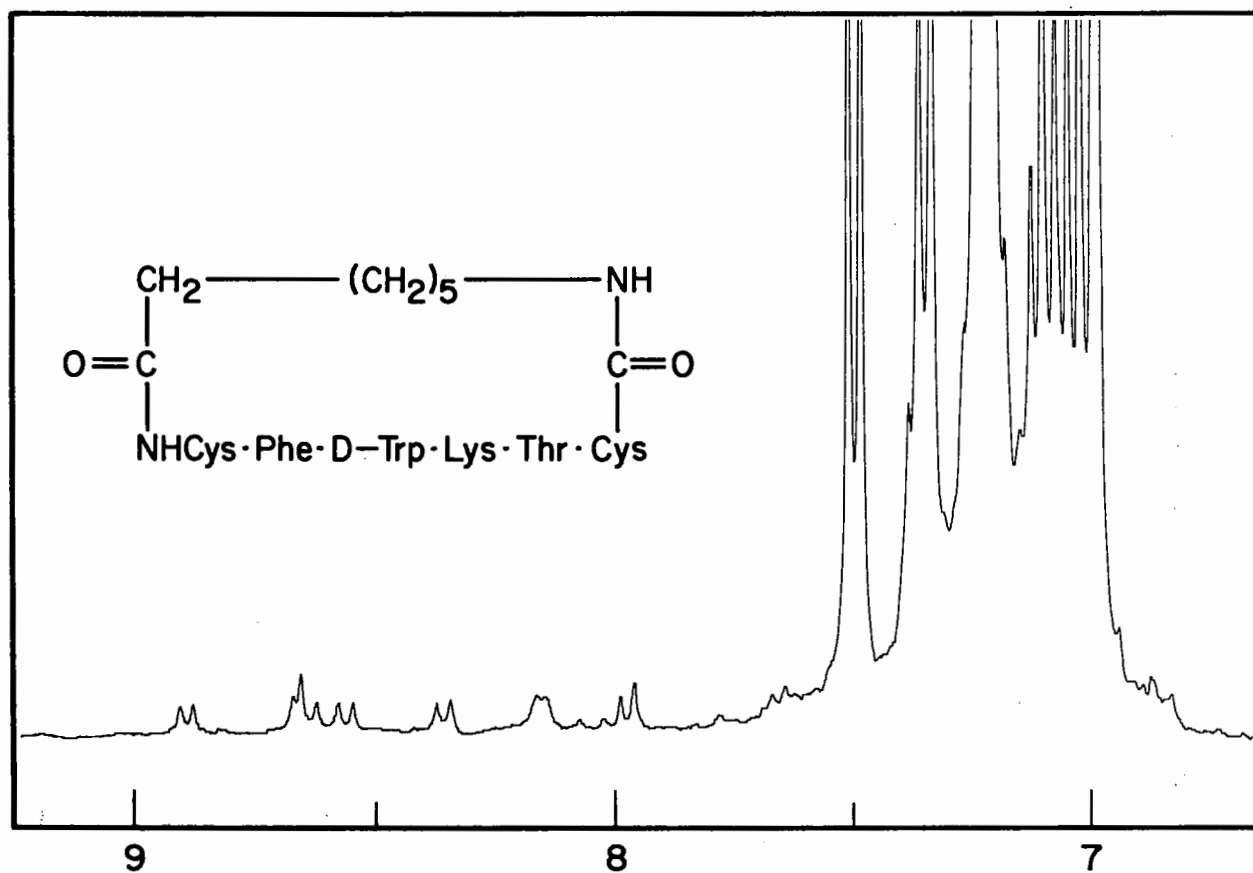


Figure 1. Oligopeptide in CD_3OD ; low field region; 300 MHz.

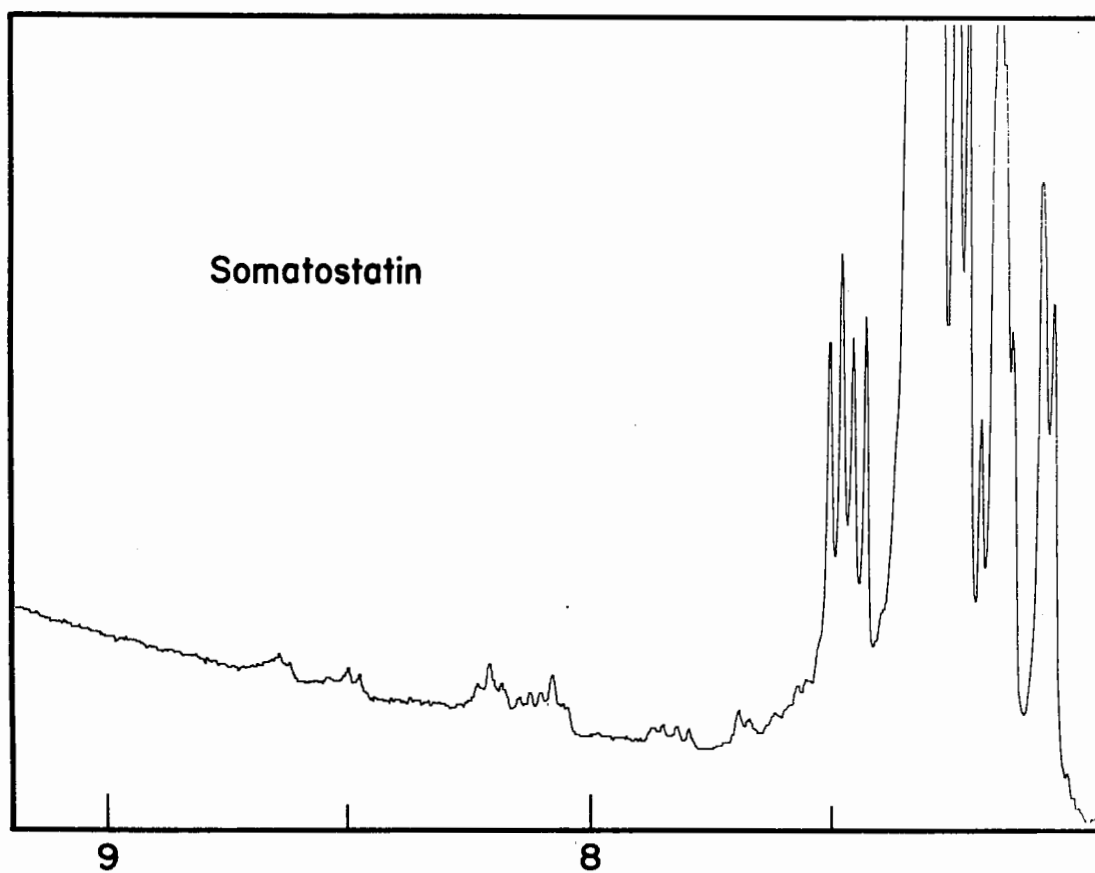


Figure 2. Somatostatin in 95% D₂O/5% H₂O; low field region, 300 MHz.

COMMISSARIAT A L'ÉNERGIE ATOMIQUE
CENTRE D'ÉTUDES NUCLÉAIRES DE GRENOBLE

AVENUE DES MARTYRS - 38 - GRENOBLE

ADRESSER LA CORRESPONDANCE :

85 X

38041 GRENOBLE CEDEX

TÉLEX : ENERGAT GRENO N° 320.323

TÉL. (76) 97-41-11

C. E. N. G.

DRF-CHIMIE ORGANIQUE PHYSIQUE

85 X

38041 GRENOBLE CEDEX France

Professor Bernard L. SHAPIRO
Department of Chemistry
Texas A & M University
COLLEGE STATION, Texas 77843
U.S.A.

RÉFÉRENCE A RAPPELER :

G/COP-79-381/mjc

VOTRE RÉF.

VOTRE LETTRE DU

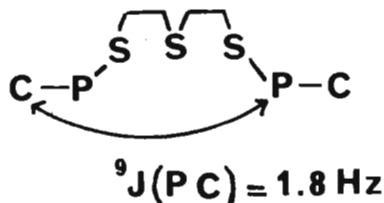
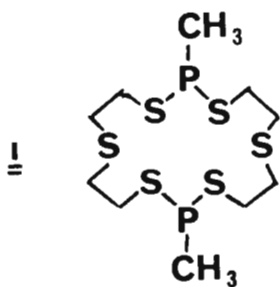
GRENOBLE, LE 22 novembre 1979

LONG-RANGE PHOSPHORUS-CARBON COUPLINGS

Dear Dr. SHAPIRO,

In the last few years we have been working on the formation and synthesis of medium-size ring compounds (ten, twelve, sixteen-membered rings) containing more than one phosphorus atom (1). By combining X-ray data and n m r spectral analysis (^1H , ^{13}C , ^{31}P), these molecules provide an interesting set of compounds in order to examine the structural dependence of the n m r parameters (spin-spin coupling and chemical shift). More recently, an interesting long range $^9\text{J}(\text{PC})$ spin coupling has been found in a sixteen-membered ring.

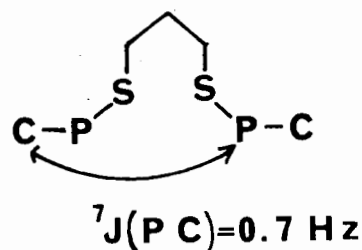
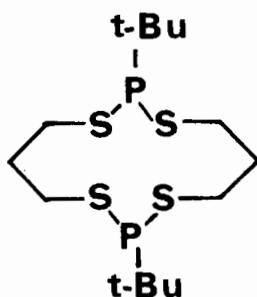
The molecule I shown below exists as a mixture of two diastereomers (a and b) as due to the two possible relative orientations of the extracyclic C-P bonds with respect to the mean plane of the ring.



Examining the ^{13}C signal of the methyl group in the $[^1\text{H}]^{13}\text{C}$ spectrum of the two isomers, one observes a significant difference. In isomer a, the signal appears as a doublet (splitting 22.2 Hz), in isomer b, one observes four lines of equal intensity (splitting 23.2 Hz and 1.8 Hz). It has been checked that these splittings are field independent by recording the ^{13}C spectra at two different frequencies (25.2 MHz and 63.0 MHz) and are thus due to spin-spin coupling. The large splitting correspond to $^1\text{J}(\text{PC})$ values, the small splitting observed in isomer b corresponds to a long range $^9\text{J}(\text{PC})$ coupling.

It is noteworthy that two nine pathways are implied between the coupled nuclei. The long range coupling which exists in only one isomer is perhaps due to a preferred conformation which brings the two phosphorus atoms in a closer vicinity in isomer b. It must be pointed out that, in the two isomers of the corresponding thioxo (P=S) sixteen-membered rings, one only observes a $^1J(PC)$ coupling and no long range coupling.

The same situation, existence of a long range coupling ($^7J(PC) = 0.7 \text{ Hz}$) in only one isomer is also observed in twelve membered ring shown below



Sincerely yours,

J.B. ROBERT

J. MARTIN

(1) - J.P. ALBRAND, J.P. DUTASTA and J.B. ROBERT, J. Amer. Chem. Soc., 96, 4584 (1974).

- J.P. DUTASTA, A. GRAND, A.C. GUIMARAES and J.B. ROBERT, Tetrahedron, 197 (1979)

- J.P. DUTASTA and J.B. ROBERT, J. Amer. Chem. Soc., 100, 1925 (1978).

- J.P. DUTASTA, J. MARTIN and J.B. ROBERT, J. Org. Chem., 42, 1662 (1977).

DÉPARTEMENT DE CHIMIE ORGANIQUE

(CNRS) ERA 07.813

PROFESSEUR B. P. ROQUES

PARIS, LE November 22th, 1979.

Professor Bernard L. SHAPIRO
Texas A & M University
Department of Chemistry
College of Sciences
College Station, Texas 77843.

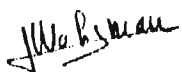
CONFORMATIONAL PREFERENCES IN SYNTHETIC
FLUORESCENT PROBES OF THE C_n DACHol TYPE

Dear Professor Shapiro,

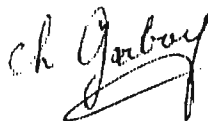
Thank you for your two reminders. In order to explore the cholinergic receptor (1) we have recently synthesized fluorescent probes made up of a dansyl group and an acylcholine moiety linked by a polymethylene chain (C_n DACHol). The 1H NMR spectra of these compounds indicate conformational preferences induced by the length of the alkyl chain. In aqueous solution at $10^{-3}M$, the longest compounds, containing more than seven methylene groups exhibit a dramatic increase in the line width of all the protons signals (Fig. 1) indicating a large inhibition in the molecular motion. However, it clearly appears that this aggregation preferentially affects the aromatic moiety as confirmed by the variation of the line widths as a function of temperature (Fig. 2).

The unexpected pharmacological properties of C_{10} DACHol, could be related to its highly lipophilic behaviour (2). Further experiments on the structure of the aggregates are now in progress, by 1H and ^{13}C NMR.

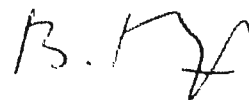
Sincerely yours ;



G. Waksman



C. Garbay-Jaureguiberry



B.P. Roques

1. G. Waksman, M.C. Fournié-Zaluski, B.P. Roques, T. Heidmann, H. Grünhagen and J.P. Changeux, FEBS Lett., 67, 335-342 (1976).
2. G. Waksman, J.P. Changeux and B.P. Roques, Mol. Pharmacol., submitted.

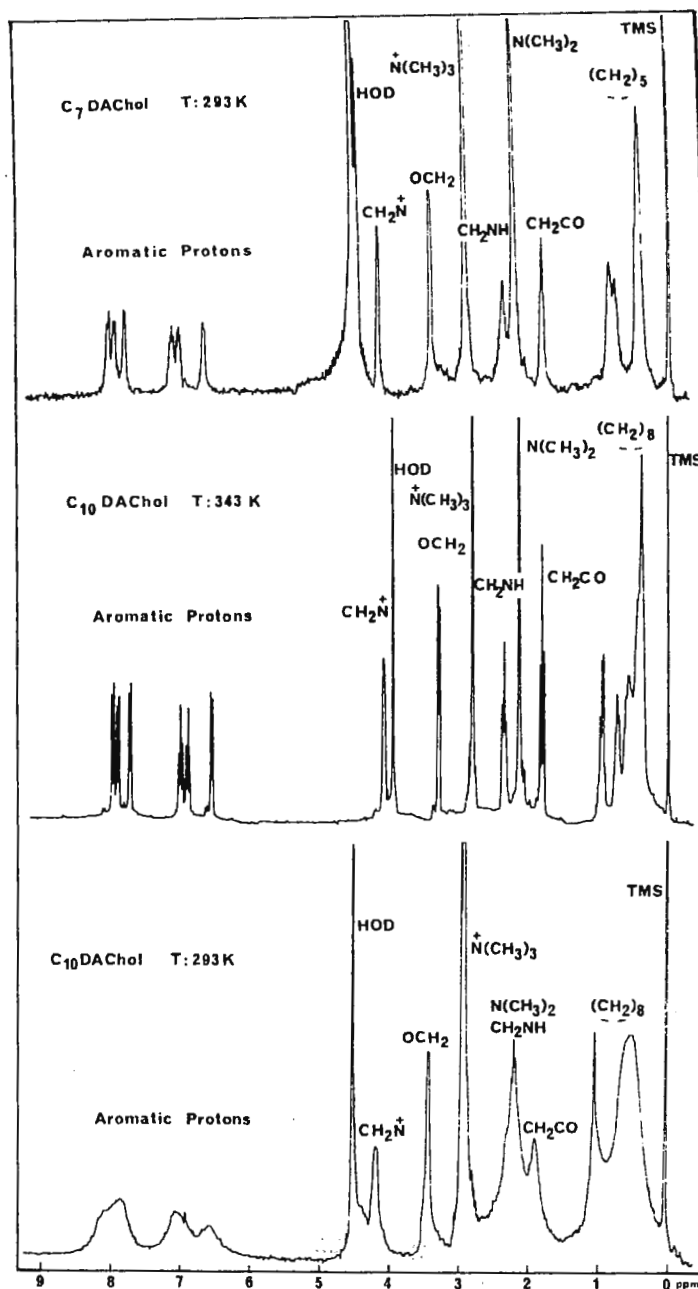


Figure 1.

^1H NMR spectra at 270 MHz in D_2O (10^{-3} M).

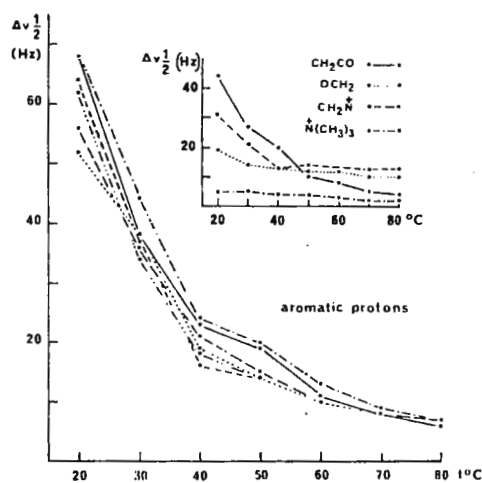


Figure 2.

$\Delta\nu_{1/2}$ $\text{C}_{10}\text{DACHol}$ as a function of temperature.



UNIVERSITY OF DENVER

An Independent University

University Park, Denver, Colorado 80208

Department of Chemistry / 303 · 753-2436

November 2, 1979

Dr. Bernard L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77843

NMR and EPR Symposia

Dear Barry:

NMR and EPR symposia will be held in conjunction with the 22nd Rocky Mountain Conference, in Denver, Colorado, August 11-14, 1980. This year at the 21st conference the NMR and EPR symposia each involved about 60 papers. In 1980 the NMR symposium will emphasize solids and natural and synthetic polymers. The Robert Vaughan Memorial Lecture is part of this symposium. The EPR sessions, which constitute the 3rd International EPR symposium*, will cover all aspects of EPR spectroscopy.

Tentative List of Plenary Lecturers:

Professor C. A. Hutchison,
University of Chicago
Professor J. H. Freed,
Cornell University
Dr. W. B. Mims
Bell Laboratories
Dr. A. D. Trifunac
Argonne National Laboratory
Professor L. Kevan
Wayne State University
Professor D. Kivelson,
University of California, Los Angeles
Professor J. S. Hyde,
National Biomedical ESR Center

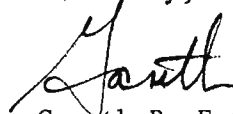
Papers will be presented in lectures and poster sessions. Abstracts are due March 24, 1980. For more information contact:

NMR: Fran Miknis
Laramie Energy Technology Center
Laramie, Wyoming 82071
(307) 721-2307

EPR: Gareth R. Eaton
Department of Chemistry
University of Denver
Denver, Colorado 80208
(303) 753-2507

* Endorsed by the International Society of Magnetic Resonance

Sincerely,

A handwritten signature in dark ink, appearing to read "Gareth", written over the printed name.

Gareth R. Eaton
Associate Professor



TEXAS CHRISTIAN UNIVERSITY
Fort Worth, Texas 76129
817-921-7195

Department of Chemistry

November 15, 1979

Dr. Barry L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77840

Dear Dr. Shapiro:

I would appreciate the use of the Newsletter to find post-doctoral slots to which I might apply. Currently, I am in the final stages of writing a Ph.D. thesis on research dealing with a study of various bile acid salts in aqueous media. Interactions with lecithin have been included in the study. Because of the complexities of proton and C-13 NMR for these molecules specifically deuterated compounds have been synthesized, and deuterium and P-31 relaxation times have been used as measures of aggregation numbers and other solution parameters.

While my background is in the use of NMR on a problem of biochemical interest, I am very much concerned in expanding my background in other areas of NMR as well. I would be pleased to send particulars to any interested persons having a postdoctoral opening.

Yours sincerely,

A handwritten signature in cursive script that reads "Gareth D. Barnard". The signature is written in dark ink and is positioned below the typed name.

Gareth D. Barnard

GDB/cru



McGill
University

Department of Chemistry
Otto Maass Chemistry Building (514) 392-4469

November 8, 1979.

Professor B.L. Shapiro,
Department of Chemistry,
Texas A & M University,
College Station,
Texas, 77843.

Dear Barry:

We would very much appreciate having the "Newsletter" carry the accompanying notice of a research opening in our Department.

Sincerely yours,

A.S. Perlin

NMR Research Spectroscopist Position

Applications are invited for the position of NMR Research Spectroscopist in the Department. The Spectroscopist will supervise the scheduling, maintenance and development of the NMR facility, and train senior graduate students and fellows in instrument operation. The facility consists of a Varian XL-200 and a Bruker WH-90, both fully multinuclear. Research in the Department is so varied that almost every kind of modern NMR problem arises. Collaboration in staff members' research projects is encouraged. Salary will be commensurate with training (\$15,000 - \$20,000). The attractions of living in Montreal are considerable. Requests for more information or applications containing a curriculum vitae and the names and addresses of two references should be sent to:

Dr. Alan Shaver,
Department of Chemistry,
McGill University,
801 Sherbrooke St., W.,
Montreal, Que. H3A 2K6.

Phone #514-392-4432.

UNIVERSITY OF VIRGINIA
DEPARTMENT OF CHEMISTRY
CHARLOTTESVILLE, VIRGINIA 22901

November 8, 1979

Dr. Bernard L. Shapiro
Department of Chemistry
Texas A & M University
College Station, Texas 77843

Dear Barry:

The Department of Chemistry is interested in selling two Perkin-Elmer nmr spectrometers. A R-20A and R-12 are the two models for sale. Both are equiped for proton observation (60 MHz). Anyone interested in these instruments may contact me at (804)924-3163 for further details.

Sincerely,



William C. Hutton

JEOL PS-100 FOR SALE

FOR SALE JEOL PS-100 CW ^1H and ^9F , ^{14}N heteronuclear decoupler, variable temperature probe. Can do T_1 and INDOR. With water/raw water cooling unit. Some spare parts. Excellent operating condition, can be seen in operation. \$20,000. Address inquiries to E. Birnbaum, Dept. of Chemistry, New Mexico State University, Box 3-C, Las Cruces, NM 88003. Phone (505) 646-2031 or -3018.

NT-Series Fourier Transform Superconductive Magnet NMR Spectrometers

The NT-Series has been conceived and designed to provide optimum performance while being fully adaptable to new techniques with minimal cost and difficulty. More than just a collection of instruments, the NT-Series represents a *completely modular approach* to FT-NMR instrumentation that allows the user to expand his system as his research needs grow and to easily accommodate new experimental techniques as they develop.

Outstanding NT-Series features include these:

- A full range of superconductive magnets from 3.5T to 11.7T in both wide-bore and narrow-bore configurations.
- Multinuclear observation with a wide variety of fixed-tune and broadband probes.
- Simultaneous acquisition, processing, and plotting for greater sample throughput.
- Simplified control of spectrometer operations and parameters by using easy keyboard commands.
- Advanced Nicolet-1180 Data System with the most comprehensive FT-NMR software package available.
- Extended dynamic range performance with 40-bit acquisition and floating-point processing.



- An expandable pulse-sequence library, including T₁, T₂, Redfield, 2D-FT, etc.
- Convenient computer-control of field shimming, observe and decoupling frequencies, sample temperature.
- Precise digital plotting with full annotation of spectral parameters and flexibility of hard-copy format.
- High-resolution studies of solids with Waugh-Pines cross-polarization and magic-angle spinning
- High-sensitivity wide-bore ¹³C studies of high molecular weight polymers.
- Automated T₁ and T₂ measurements.
- Chemical dynamics studies.
- Temperature-programmed experiments.
- ³¹P experiments on living organs.

The multiple-technique NT-Series spectrometers provide the user with the ability to easily adapt to the newest techniques and experimental configurations.

Some of these are:

NTC NICOLET
TECHNOLOGY
CORPORATION

145 East Dana Street
Mountain View, California 94041
Telephone: 415/969-2076

For the past 1½ years
the FX 90Q has provided a close look
at Dynamic Range (PPM conc.) at
approximately ½ the cost of SCM units.

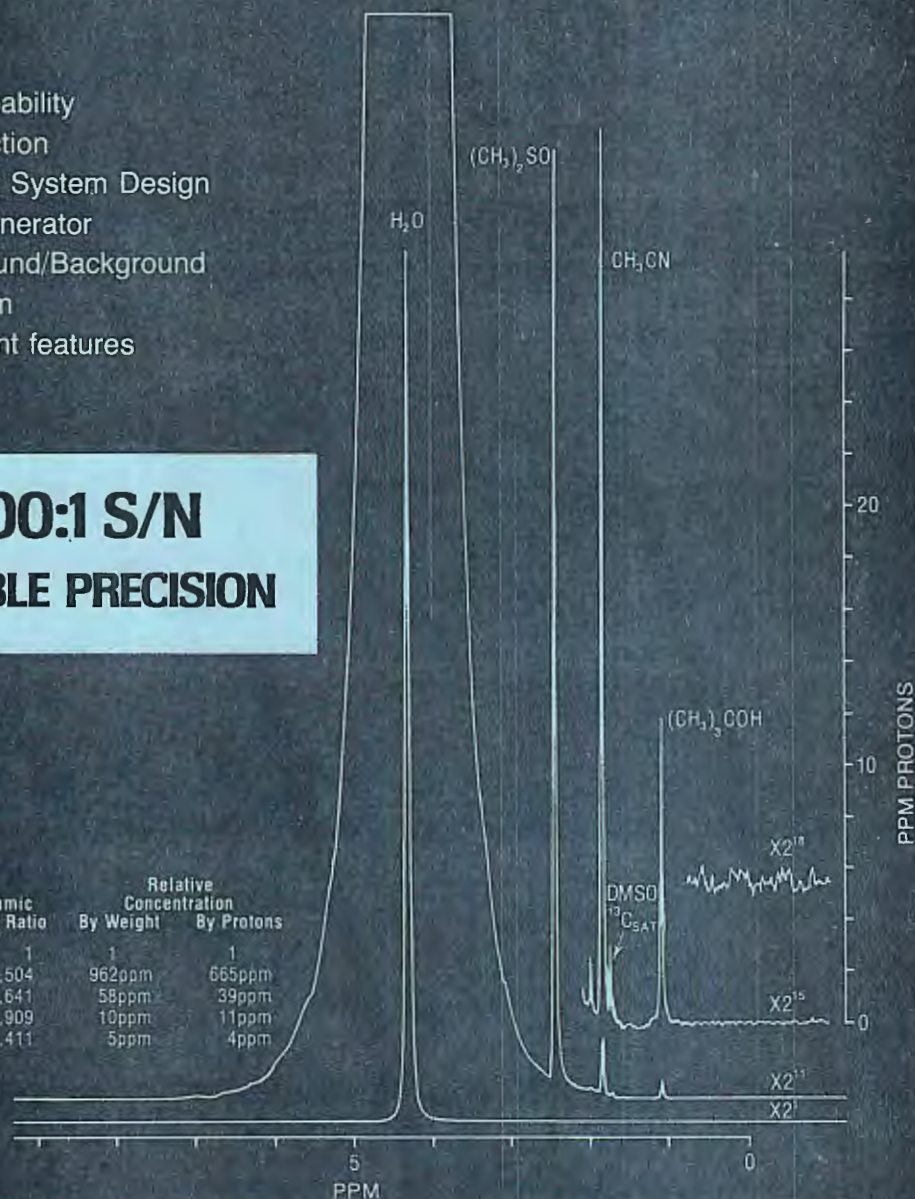
You Also Get:

- Omni-Probe System
- Dual Carbon/Proton Capability
- Digital Quadrature Detection
- Interchangeable Modular System Design
- Programmable Pulse Generator
- Comprehensive Foreground/Background
- Light Pen Control System
- And many more important features

8,700,000:1 S/N
INTEGER DOUBLE PRECISION

5mm sample
8192 data points (32 bit words)
Transform time 30 sec
196,340 scans (22° pulse)
1.224 sec repetition
2000Hz plot

Compounds	ml	%Protons	Dynamic Range Ratio	Relative Concentration	
				By Weight	By Protons
Water	800	100%	1	1	1
DMSO	0.70	0.0665%	1,504	962ppm	665ppm
Acetonitrile	0.06	0.0039%	25,641	58ppm	39ppm
t-butanol	0.01	0.0011%	90,909	10ppm	11ppm
DMSO- ¹³ C Satellite	—	0.00037%	273,411	5ppm	4ppm



By the way, the same data system
is also used with the FX60QS
(Magic Angle Solids System)
and the FX200 (Dual C/H Probe).

Call or write for complete details...

JEOL

235 Birchwood Ave., Cranford, NJ 07016
201-272-8820