THE
NMR
NEWSLETTER

No. 470

November 1997

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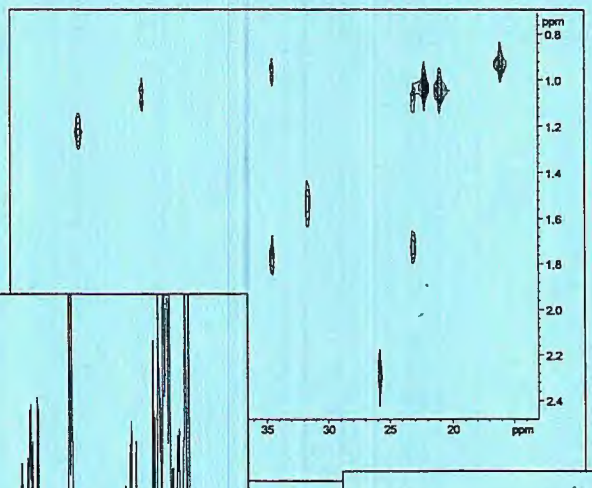

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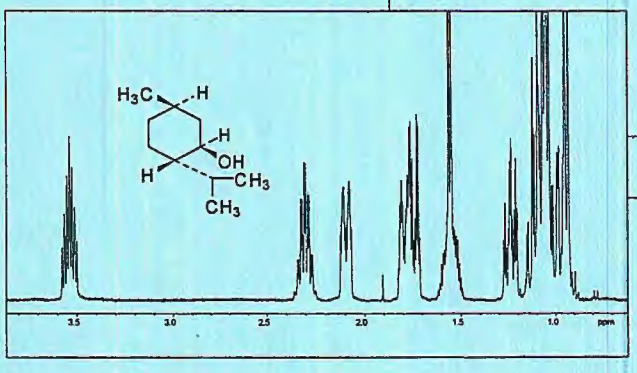

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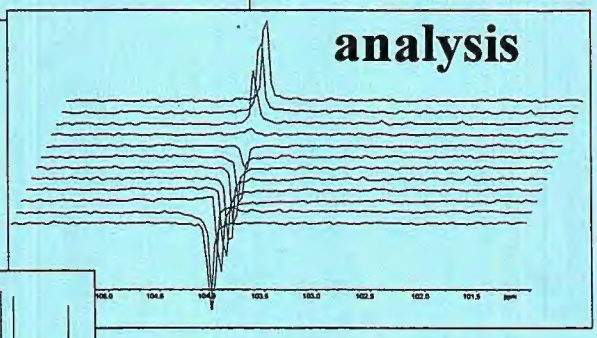

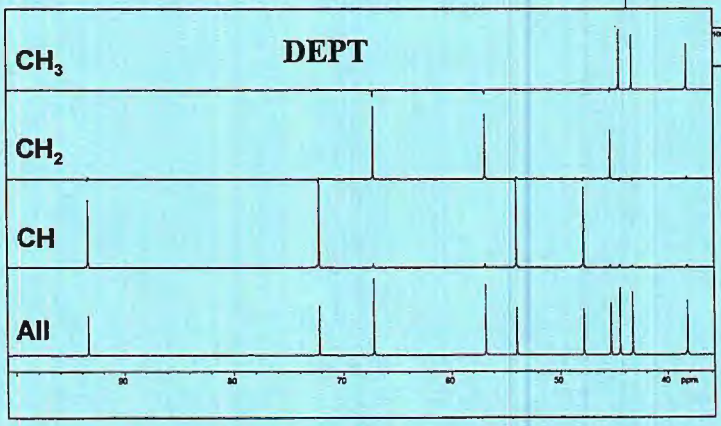

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FORTHCOMING NMR MEETINGS

Symposium "Magnetic Fields: Recent Advances in Diagnosis and Therapy", London, Ont., Canada, **November 14 - 16, 1997**. See Newsletter 468, 8.

39th ENC (Experimental NMR Conference), Asilomar Conference Center, Pacific Grove, CA, **March 22 - 27, 1998**; Contact: ENC, 1201 Don Diego Avenue, Santa Fe, NM 87505; (505) 989-4573; Fax: (505) 989-1073; Email: enc@enc-conference.org. See Newsletter 460, 41.

NATO ARW "Applications of NMR to the Study of Structure and Dynamics of Supramolecular Complexes", Sitges (Barcelona), Spain, **May 5 - 9, 1998**. Contact: Prof. M. Pons, Dept. Quimica Organica, Univ. de Barcelona, Mart I Franques 1, 08028 Barcelona, Spain; http://www.ub.es/nato/nato.htm; e-mail: miguel@guille.qo.ub.es

Sixth Scientific Meeting and Exhibition, International Society for Magnetic Resonance in Medicine, Sydney, Australia, **April 18 - 24, 1998**. Contact: International Society for Magnetic Resonance in Medicine, 2118 Milvia St., Suite 201, Berkeley, CA 94704; 510-841-1899.

Fifth International Conference on Heteroatom Chemistry, London, Ont., Canada, **July 5 - 10, 1998**. For details, see Newsletter 468, 40.

XIVth International Conference on Phosphorus Chemistry, Cincinnati. OH, **July 12 - 17, 1998**. For details, see Newsletter 468, 40.

NMR Symposium at the 40th Rocky Mountain Conference on Analytical Chemistry, Denver, CO, **July 27 - 30, 1998**. Contact: Dr. Robert A. Wind, Battelle/Pacific Northwest National Laboratory, P.O. Box 999, MS K8-98, Richland, WA 99352; (509) 376-1115; Fax: (509) 376-2303; Email: ra_wind@pnl.gov. See Newsletter 470, 8.

Additional listings of meetings, etc., are invited.

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Dr. B.L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

(received 10/10/97)
October 2, 1997

Dear Barry: Subject: High field, high temperature superconducting probe.

Last spring, Varian and Conductus delivered a high temperature superconducting probe for our 600 MHz spectrometer. Many were dubious about the potential for sensitivity gains at this high field. We would like to report that the probe met most of our expectations, especially with F-19.

The probe which we received contains inner H-1 and outer F-19 superconducting coils. We wanted this geometry to accommodate both H-1 and F-19 NMR with a single probe. Our 600 has a broadband lock channel, so that we can lock on F-19 or H-1 while observing H-1 or F-19, respectively. The sensitivity of the H-1 channel is such that we are also able to lock on the residual protons in 99.8% $CDCl_3$. With our Varian software, we are able to play some games with control of the lock channel so that we can both decouple and lock on the same nucleus, permitting heteronuclear decoupling experiments.

On our 5 year old instrument we were able to improve sensitivity 5-fold compared to standard probes optimized for H-1 detection. On newer instruments, perhaps the (n3500:1 for 0.1% ethyl benzene) sensitivity gains might not be so large. We have been able to obtain reasonable F-19 spectra from as little as 12 ng of low MW material in 4-12 hours. While the sensitivity gains are greater for H-1 NMR (the filling factor for the H-1 coil is much better than for the F-19 coil), a background signal from the probe combined with additional signals from solvent impurities has prevented us from doing H-1 NMR with less than ca. 100 ng of material. A combination of better sample handling techniques, purer deuterated solvents and a background free probe should permit us to do NMR on 1-10 ng of material in overnight experiments.

After the first couple of times, setup has become routine. Operation of the probe, sample changes, shimming, etc. is not too different from standard probes. We are encouraged with the future prospects for low temperature probe technology.

Best regards,

Robert Rachocki Dale G. Ray III Peter L. Rinaldi

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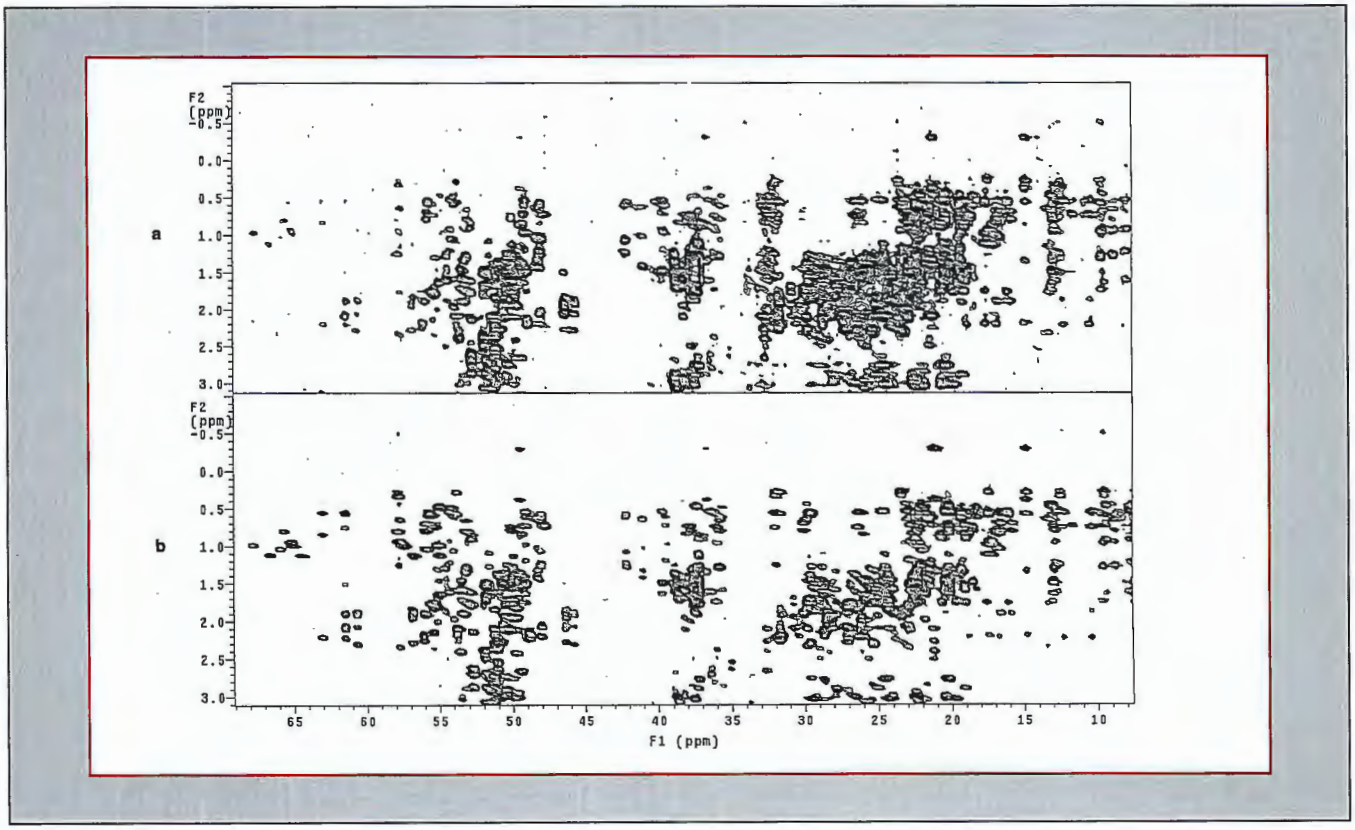

HCCH-TOCSY[1] spectra of 1 μM [^{13}C,^{15}N]-labeled ubiquitin in 90% H_2O/10% D_2O. Data acquired using a 5 mm $^{1}H\{^{13}C/^{15}N\}$ X,Y,Z PFG Triple Resonance probe, a 600 MHz UNITY*INOVA* spectrometer, and a.) INEPT ^{13}C-^{1}H polarization transfer and b.) Hartmann-Hahn ^{13}C-^{1}H polarization transfer (γB_2: 7 kHz ^{13}C and ^{1}H). Both sets of spectra employed a ^{13}C-^{13}C DIPSI spin lock of 15 ms at 40 watts. Z-gradient strengths of up to 70 gauss/cm were utilized. No presaturation or post-acquisition solvent suppression was used to remove the residual water.

High Power ^{13}C-^{13}C and ^{13}C-^{1}H Spin Lock and Gradient-Based Water Suppression

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[1]Kay, L.E., Xu, G-Y., Singer, A.U., Muhandiram, D.R., and Forman-Kay, J. D., *J. Magn. Reson., Series B*, 101, 333-337 (1993).

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Carlsberg Laboratory

Danish Instrument Center for NMR Spectroscopy of Biological Macromolecules

Prof. B.L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto CA 94303, **USA**

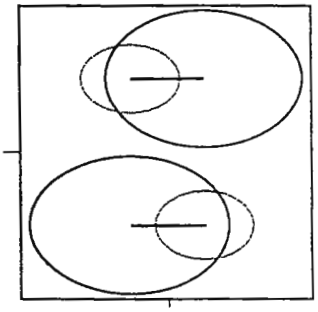
September 17, 1997
(received 10/8/97)

Dear Barry:

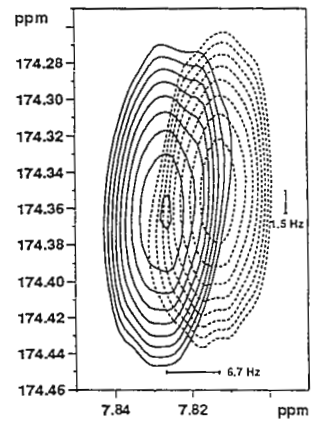
This letter initiates the subscription of Carlsberg Laboratory. Carlsberg Laboratory hosts the Danish Instrument Center for NMR Spectroscopy of Biological Macromolecules currently equipped with a 750 MHz Varian Unity Inova spectrometer to be replaced by a corresponding 800 MHz instrument once it becomes available. A special building housing the equipment is placed in a quiet corner in the garden of Carlsberg Research Center. The spectrometer is owned by the Danish Natural Science Research Council and is open for academic and industrial users in Denmark.

I have established a research group of currently three postdocs here working on spin engineering and assisting internal and external users of the Instrument Center with their applications. In future contributions to the Newsletter you will learn about the work of other groups at Carlsberg Laboratory using NMR.

Below I want to give you a little appetizer of two ongoing projects.



A source of systematic error in measurement of J coupling constants in proteins by E.COSY-type methods is passive spin flips during mixing times where passive spins were supposed to not change their state. That leads to additional unresolved cross talk peaks at the positions of the dashed contours. If the J coupling constant is determined as the horizontal displacement of the two (main) peaks too small a value is measured and the error is easily in the 10-20% range. We have found a way to suppress the undesired peaks causing this error.



Ambiguity in the Karplus relations for three-bond coupling constants makes it insufficient with just one J for the determination of dihedral angles. We have designed 2D and 3D NMR experiments where $^{3}J(H^{N}\text{-}H^{\alpha})$ and $^{3}J(C'\text{-}H^{\alpha})$ relevant for the angle ϕ in the protein backbone can be determined with high sensitivity from a single spectrum. These two coupling constants are the coordinates of 2D displacement vectors and the two peaks of such doublets are edited into two subspectra that can be overlaid (full line and dashed contours).

Sincerely yours,

Ole W. Sørensen Axel Meissner Thomas Schulte-Herbrüggen Morten D. Sørensen

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470-6

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Fax: 301 435-2413
Internet: tbecker@nih.gov

National Institutes of Health
Bethesda, Maryland 20892

October 17, 1997
(received 10/20/97)

Dr. B. L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

"New Directions in NMR" and Old Reminiscences

Dear Barry:

A large group of NMR devotees gathered in the Mellon Institute auditorium on September 20 for *New Directions in NMR: A Symposium Honoring Aksel A. Bothner-By, Josef Dadok, Irving J. Lowe and Robert T. Schumacher.* The four honorees have spent most of their careers at either Carnegie Mellon University or the University of Pittsburgh, and the symposium was arranged by Chien Ho and his colleagues at the Pittsburgh NMR Center for Biomedical Research, which is a joint Pitt-CMU laboratory.

As a former Mellon Institute researcher, you would have been interested in the meeting, which interspersed much discussion of early NMR developments in Pittsburgh and elsewhere with innovative ideas that are pointing the way for future advances. There was a stellar list of speakers, headed by Richard Ernst, who dug into his apparently boundless collection of old NMR documents to describe a number of contributions over the years that were developed or described in Pittsburgh, often at the ENCs that were held there for 10 years or so. He reminded us that at the Mellon Institute you and Aksel had begun the **M**onthly **E**cumenical **L**etters from **L**aboratories **O**f **N**MR. What fraction of current readers of *The NMR Newsletter* know its original name?

Many other eminent speakers covered a wide range of topics. Among the historical names in NMR were Charlie Slichter, John Waugh, Paul Lauterbur, Ray Freeman, Erwin Hahn and John Pople, while John Markley, Jim Prestegard, Lila Gierasch and Ad Bax represented a younger generation. I thought all the talks were excellent, and the atmosphere at the symposium and an evening banquet was delightful.

Each of the four honorees gave a short talk referring to some aspects of his work, but only Aksel [known as A_2B_2 to us early NMR types interested in analysis of spin systems] set some of his remarks to music. Perhaps he can supply the complete lyrics for interested *Newsletter* readers.

Best wishes.

Sincerely,

Ted

Edwin D. Becker

Aksel A Bothner-By
6317 Darlington Rd.
Pittsburgh, PA 15217

10 October 1997
(received 10/14/97)

Dr. B. L. Shapiro
966 Elsinore Ct.
Palo Alto, CA 94303

Dear Barry

On the 20th of September some of my good friends threw a party for me, and for Joe Dadok, Irving Lowe, and Bob Schumacher, in the form of a Symposium held at Pittsburgh, celebrating 40 years of work on NMR in Pittsburgh. We all had a glorious time, and sentimental reminiscences were flowing like wine. We were treated to some spectacular talks, too, with impressive new ideas and accomplishments in applying NMR to all sorts of new things.

As I am just about to bow out of this business, I was rash enough to compose some lyrics to an old show tune, and actually sing it to the assembled multitude at the end of the proceedings. The idea was to convey to all of them my feelings about the joys, satisfactions, and occasional problems in spending most of my life working in this field. It went over pretty well, and in fact, Ted Becker suggested (as you know) that I send the words to you for the NEWSLETTER. So here they are. I do not expect to get credit for a technical contribution for this letter.

THERE'S NO BUSINESS LIKE OUR BUSINESS

There's no business like our business, like no business I know -
There you sit a-staring at the ceiling
Wondering why the damn thing will not go
All at once you get this *marvelous* feeling
You understand it, and so.....

You can do things, all sorts of new things, things that none have ever done before
You can make those nuclei turn somersaults, do the WALTZ, refocus faults,
You can bring precession to six complete halts,
Then go on with the show.

And, Oh! the wonderful feeling, you know you'll soon be a star.
You send the nuclei a-reeling, then you're talking at Asilomar
You can name it what you find appealing,
(Well camelspin might be too far).

Still there's no business like our business
It gives me an inward glow -
Everybody sitting here has seized the chance,
To join the dance, and make them prance.
Just write a few proposals and you'll soon get grants
To go on with the show!

Best, Aksel

Pacific Northwest National Laboratory
Operated by Battelle for the U.S. Department of Energy

October 9, 1997

Dr. Barry L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

NMR Symposium at the 40th Rocky Mountain Conference on Analytical Chemistry

Dear Barry:

The NMR Symposium at the 40th Rocky Mountain Conference on Analytical Chemistry will take place Monday, July 27, to Thursday, July 30, 1998 at the Hyatt Regency Denver in downtown Denver, Colorado. The program's emphasis is on developments and applications of solid state NMR, and will consist of invited lectures and contributed papers for oral and poster presentations. In 1997, we had a record attendance of 170 participants and 124 oral and poster contributions.

Each year, we dedicate a half-day session of the NMR Symposium to the memory of Professor Robert Vaughan. We are fortunate to have as the Vaughan Lecturer for 1998 Professor Shimon Vega of the Department of Chemical Physics, The Weizmann Institute of Science, Rehovot, Israel.

The NMR Symposium is being organized by Robert Wind - chair,Jeff Reimer - co-chair, Lucio Frydman, Clare Grey, John Hanna, Gina Hoatson, and Steve Sinton. The sessions will include the areas of macromolecules (including bio-), inorganic materials including glasses, new techniques and applications, a combined NMR/EPR session, and a session about computing NMR parameters. Further information about the program, including the abstracts of talks and posters, will appear as available at our Web site: http://india.cchem.berkeley.edu/~rmc/

Those who have attended previous meetings should be on the mailing list for the Conference, and will receive abstract forms, both by regular mail and by e-mail. To be added to the mailing list, or for further information, please contact me at: Battelle/Pacific Northwest National Laboratory, P.O. Box 999, MS K8-98, Richland, WA 99352, USA.
Phone: (509) 376-1115, Fax: (509) 376-2303, E-mail: ra_wind@pnl.gov

Sincerely yours,

Robert A Wind

Robert A. Wind

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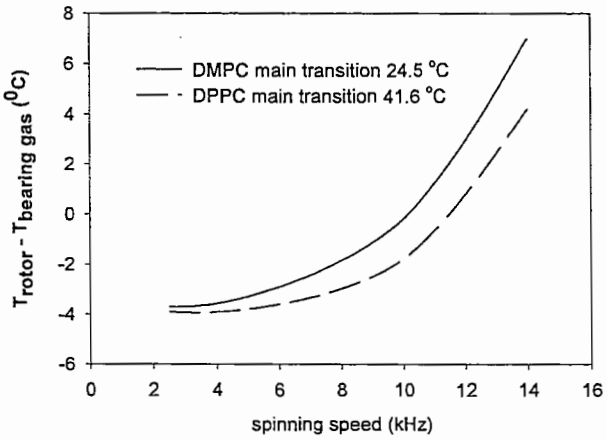
National Institute on Alcohol
Abuse and Alcoholism
Rockville, MD 20852

October 11, 1997
(received 10/18/97)

Temperature Control of 4 mm MAS Rotors

Dear Dr. Shapiro,

Many of our investigations on polyunsaturated lipids make use of high resolution magic angle spinning NMR. Because some of the lipid NMR parameters are very sensitive to temperature changes, the experiments must be conducted with accurate temperature control. Warned by recent reports of sample heating in MAS experiments (1,2), we calibrated the temperature inside the MAS rotor using the well known main phase transition temperatures of the lipids dimyristoylphosphatidylcholine and dipalmitoylphosphatidylcholine. Experiments were conducted on a DMX500 spectrometer equipped with a widebore 11.7 Tesla magnet, a BVT-2000 variable temperature accessory, a MAS control unit, and a triple resonance variable temperature CPMAS probe, all purchased from Bruker Instruments, Inc. The bearing gas (compressed nitrogen) was chilled to a temperature of 5 -10 ^{0}C and then heated inside the probe. Gas temperature is controlled by a sensor placed in the bearing gas stream before the gas enters the MAS stator. The drive gas temperature was approximately 22 ^{0}C. The lipids (1-3 mg) were dispersed in water, transferred to a home-built Kel-F insert, and sealed in a 4 mm Zirconia rotor with a Kel-F spinner cap. The lipid sample fills a small spherical volume in the center of the rotor. The temperature of the bearing gas when the lipids went through their phase transition was recorded. The figure below demonstrates the difference between the sample temperature in the rotor and the temperature of the compressed bearing gas.



At low spinning speed the true sample temperature was always a few degrees lower than the temperature of the bearing gas due to the Joule-Thompson effect of the expanding gas. However, at spinning speeds above 5 kHz sample temperature increased significantly because of friction between the rotor and the bearing gas. Most of the heating takes place at the two bearings at each end of the rotor while the center of the rotor is still chilled by the expanding gas, causing significant temperature gradients across the sample. As a result, at 14 kHz spinning speed, the width of the transition increased by several degrees despite small sample size and location in the center of the rotor, far away from the bearings. The centrifugal forces at higher spinning speed may raise the phase transition temperature of lipid near the rotor walls somewhat. However, using the known densities of lipid and water, we calculated that this effect broadens the transition by less than 1 °C.

We noticed that the sample heating caused by the friction from the bearing gas while spinning at 14 kHz is not very reproducible. Sample temperature depended on bearing gas pressure, the rotor, the sample, the length of the experiment, the time of the day, the phase of the moon, etc.,etc. Therefore, experiments which require precise temperature control with minimal temperature gradients are difficult to conduct at higher spinning speed. The encouraging news is that, in particular, the polyunsaturated lipid proton resonances have incredible resolution at spinning speeds as low as 2.5 kHz where sample heating has not been observed.

Sincerely yours,

Krishnamurty Anandhi

Klaus Gawrisch
gkl@cu.nih.gov

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1. F.G. Riddell, R.A. Spark, G.V. Günther, Magnetic Resonance in Chemistry 34 (1996) 824-828
2. A.R. Grimmer, A. Kretschmer, V.B. Cajipe, Magnetic Resonance in Chemistry 35 (1997) 86-90

UNIVERSITY OF THE PACIFIC

College of the Pacific

Department of Chemistry

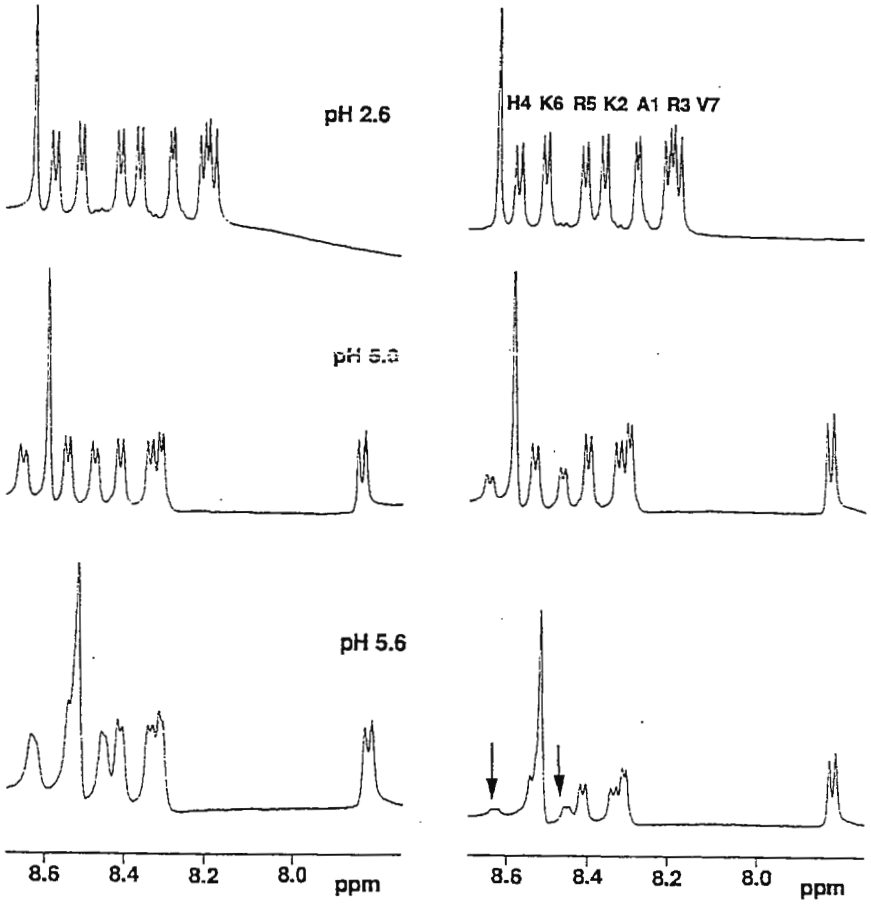
Amide Proton Exchange in Short Peptides

(received 10/3/97)

Dear Barry

It has only been a few months since I have been out of hospital and most of my time has been spent with getting ready for Fall semester and catching up on a few manuscripts initiated before Mr. C. raised his ugly visage on my career. Some very good Stanford oncologists and a bone marrow transplant have put me back in action but I am not sure I have anything worthy of the infamous "pink ultimatum" sent to me recently. Forgive me if I may merely pass on an observation of a recent reviewer who pointed out that the choice of water suppression method used to observe the amide resonances of a peptide may critically depend on the pH.

The following spectra are of a seven amino acid peptide (N-acetyl AKRHRKV) in 90% H_2O taken with 1 1 water suppression at 500 Mhz either without (left) or with presaturation (right hand spectra, τ_{pre} =1.5 sec). It is clear that for acidic solutions, where the exchange rate is minimal, the methods give equivalent results. In more alkaline solutions where the exchange rate is faster, the presaturation method leads to saturation transfer to the more rapidly exchanging amide protons (arrows) and that these doublets are suppressed. What is most surprising is the marked difference between the behavior of individual amide N-H groups in a peptide too short to have any traditional secondary structural elements. The use of presaturation for various pulse-lengths before a 1 1 or 1 3 3 1 pulse sequence is still be a useful 1D method for exploring individual exchange rates for amide resonances in peptides as a function of pH (16 scans per pH). One can extract k_{OH} rate data from the selective diminution of amide resonances as a function of pH.



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Dr. Barry Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CA 94303

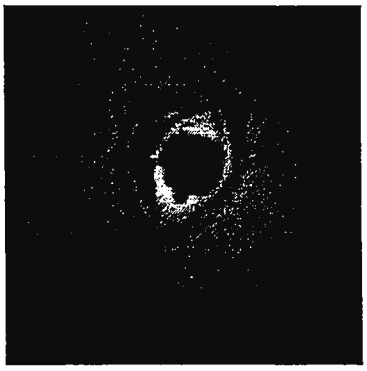
Villeurbanne, October 14th 1997
(received 10/22/97)

In-vitro endovascular NMR imaging at 2 Tesla

Dear Professor Shapiro,

For atherosclerotic lesions characterization, experiments have been recently performed on our 2 Tesla Oxford magnet (310 mm bore) using a SMIS console and home made radiofrequency dedicated coils. We have developped different shapes of receiver coils with a diameter of 1.1 mm to 4 mm. Human arteries taken out post mortem were placed in a saline solution and imaged by NMR with a receiver probe inserted inside the artery. Using spin-echo sequence, we got 2D images with a field view of 34 mm and a spatial resolution of 273 µm. The sensitivity depth was sufficient to see the artery layers (media and adventitia). On T1 weighted images, calcified lesions could be delineated.

T1 Weighted
TR/TE = 600/22 ms



T2 Weighted
TR/TE = 2000/50 ms

This approach provides high-resolution images useful to determine the stenosis level and to observe the arterial wall layers including atherosclerotic lesions. *In-vivo*, endovascular imaging is now on the way.

Sincerely Yours,

Linda CHAABANE Jean-Michel SERFATY Christine MARGUET Philippe DOUEK André BRIGUET

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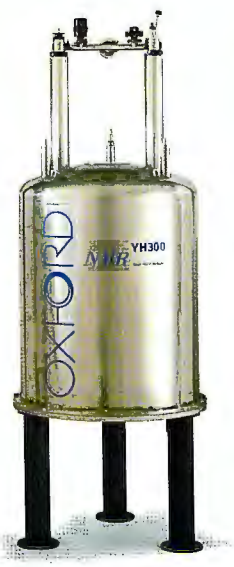

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Operating Field (Tesla)	4.7	7	7	9.4	11.7	14
NMR Operating Frequency (MHz^1H)	200	300	300	400	500	600
Field Stability (Hz/hour ^1H)	<2	<3	<15	<10	<12	<12
Axial 5 Gauss Stray Field Contour (Metres)	2.6	2.7	4.2	3.3	4.5	5.0
Radial 5 Gauss Stray Field Contour (Metres)	2.0	2.2	3.3	2.6	3.5	3.9
Cryostat						
Standard Cryostat Minimum Helium Refill Interval (Days)	203	203	120	180	150	90
Standard Cryostat Helium Refill Volume (Litres)	68	68	101	60	80	135
Year Hold Cryostat Option Available	✓	✓	X	X	X	X
Nitrogen Refill Interval (Days)	14	14	22	14	18	18
Nitrogen Refill Volume (Litres)	61	61	135	67	131	121
Nominal Room Temperature Bore Diameter (mm)	89	89	150	89	89	89
Minimum Operational Ceiling Height (Metres)	2.9	2.9	4.1	2.9	3.4	3.4
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September 19, 1997
(received 9/29/97)

Dr. Bernard L. Shapiro
Editor/Publisher
TAMU NMR Newsletter
966 Elsinore Ct.
Palo Alto, CA 94303 USA

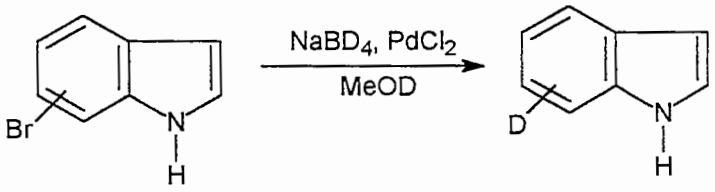
Correlation Between Deuterium Isotope Effects and π-Bond Order in Indole

Dear Professor Shapiro:

Superconducting NMR spectrometers, due to their high stability, have enabled in recent years very precise determination of small changes in chemical shifts (in the ppb range) induced by isotopic substitution in a molecule. Studies related with the structural features that influence deuterium-induced isotope effects ($^2H/^1H$) on ^{13}C NMR chemical shifts [$^n\Delta\delta = \delta\ (^{13}C\text{-}^2H) - \delta\ (^{13}C\text{-}^1H)$] have revealed interesting correlations[1].

In a previous study we have shown a dependence of the ^{13}C NMR methoxy substituent chemical shift values on π-bond order of fused aromatic compounds[2]. To investigate the dependence of isotope effects on π-bond order[3] in indole, we have prepared a series of monodeuteriated 4-*d*, 5-*d*, 6-*d* and 7-*d*- indoles (**1a-d**).

All ^{13}C NMR spectra were recorded on a Varian Gemini 300 spectrometer operating at 75.4 MHz using DMSO-d_6 as solvent. Mixtures of deuteriated and non-deuteriated indoles **1a-d** in *ca.* 4:1 ratio were used for the determination of $^n\Delta$ isotope shifts (Table). Deuteriated indoles **1a-d** were synthesized by reduction of the corresponding brominated indoles[4] **2a-d** with $NaBD_4$ in the presence of $PdCl_2$/MeOD[5].



2

a 4-Br
b 5-Br
c 6-Br
d 7-Br

1

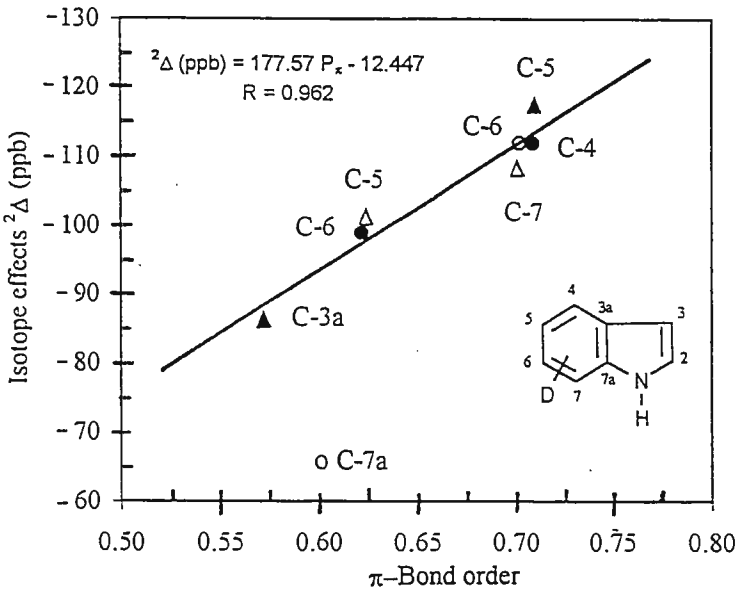
a 4-*d*
b 5-*d*
c 6-*d*
d 7-*d*

Effects over one ($^1\Delta$) and two-bonds ($^2\Delta$) in the series **1a-d** are similar in magnitude to those observed in other conjugated systems[6]. However $^2\Delta$ at the quaternary C-7a atom in **1d** is considerably smaller (Table). The $^1\Delta$ and $^2\Delta$ effects are negative, i.e. the respective carbons are shielded.

As shown in the Figure the effects over two-bonds ($^2\Delta$) for carbons *ortho* to deuterium correlate well with the π-bond order, with the exception of that owing to C-7a, neighbor to the heteroatom, yielding a correlation coefficient of 0.812. Elimination of the C-7a point improves the correlation coefficient to 0.962.

Table. Isotope Effects $^{n}\Delta\ ^{13}C(D)$ of Indole (in ppb).

Comp.	$^{1}\Delta$	$^{2}\Delta$	$^{3}\Delta$
1a	-276 (C-4)	-86 (C-3a)	-37 (C-3)
		-117 (C-5)	-9 (C-6)
1b	-267 (C-5)	-112 (C-4)	-16 (C-3a)
		-99 (C-6)	-10 (C-7)
1c	-270 (C-6)	-101 (C-5)	-7 (C-4)
		-108 (C-7)	-
1d	-257 (C-7)	-112 (C-6)	8 (C-3a)
		-64 (C-7a)	-13 (C-5)



	Observed carbon	π-Bond order[7]	$^{2}\Delta$ (ppb)
▲ 4-*d*	C-3a	0.57	-86
	C-5	0.71	-117
• 5-*d*	C-4	0.71	-112
	C-6	0.62	-99
Δ 6-*d*	C-5	0.62	-101
	C-7	0.70	-108
o 7-*d*	C-6	0.70	-112
	[a]C-7a	0.60	-64

[a]Point excluded from the correlation

1. S. Berger, in *Isotope Effects in NMR Spectroscopy, NMR Basic Principles and Progress*, edited by P. Diehl, E. Fluck, H. Günther, R. Kosfeld, J. Seelig, Springer, New York, (1990).
2. P. Joseph-Nathan, C. García-Martínez, M. S. Morales-Ríos, *Magn. Reson. Chem.*, **28**, 311 (1990).
3. L. Ernst, H. Hopf, D. Wullbrant, *J. Am. Chem. Soc.*, **105**, 4469 (1983).
4. B. E. Leggetter, R. K. Brown, *Can. J. Chem.*, **38**, 1467 (1960).
5. T. R. Bosin, M. G. Raymond, A. R. Buckpitt, *Tetrahedron Lett.*, 4699 (1973).
6. R. H. Martin, J. Moriau, N. Defay, *Tetrahedron*, **30**, 179 (1974).
7. D. A. Bochvar, A. A. Bagatur'yants, *Theor. Exp. Chem.*, **3**, 483 (1967).

Sincerely yours,

Martha S. Morales Ríos

Pedro Joseph-Nathan

Irma Salgado Escobar

Pharmacia & Upjohn

October 2, 1997 (received 10/6/97)

lfgt -- a macro for the Bruker BSMS

Dear Dr. Shapiro,

Bruker spectrometers equiped with the BSMS digital lock system are a great improvement over the previous Bruker lock system, and they provide a much more stable spectrometer system. The digital filter in the field/frequency lock loop is a central element in the improved system, providing great flexibility to the user who might use a variety of deuterated lock substances. In particular, the loop gain, loop filter, and loop time are three parameters whose optimized values are important to good quality spectra. Conversely, poor choices for these parameters can cause severe problems -- just try to obtain the $CHCl_3$ lineshape specifications with these three parameters grossly misset!

I have obtained good values for loop filter, gain, and time over the typical range of values for lock gain (84 dB to 120dB), and parameterized the results with Jandel's TableCurve software. The values obtained can be entered from the command line for each new sample, but one quickly tires of this. So I wrote a small AU program which automates the process. The program interrogates the BSMS for the value of lock gain, and, based on that alone, it loads an interpolated value of loop filter, loop gain, and loop time back into the BSMS. These equations are empirical; they could be determined exactly if the source code were known. I think that the digital filter was designed so that small deviations from true optimal values do not seriously degrade lock performance.

For repetitive samples the "edlock" command could be used to enter these values in the table for each solvent and each probe, but I am constantly changing probes and solvents so that Bruker's table lookup method is not very effective for my work. The default values set into the edlock tables at instrument installation time are useable, but not optimal, especially for mixed solvents.

I list below the AU program lfgt. All space and some comments have been removed. Also, I did not attempt to optimize the code once it worked. This code compiles within the edau command of XwinNMR version 1.3, using an SGI INDY R5K under IRIX 5.3. For widely varying samples such as I receive, it is convenient to lock, touch up the shims, use "AUTO GAIN", and then just type lfgt at the command prompt to optimize the lock digital filter behavior. Of course if one does not set up the lock power and lock phase correctly in each instance, this optimization doesn't do much good.

```
BSMS_PROGRAM    /* must be the first statement ****/
#  define USE_SXUTIL
double lockgain, loopfilter,loopgain,looptime,a,b,c,d,e,x;
GETBSMSVAL(BSN_LOCK_GAIN,lockgain);
x = lockgain;
if ( (x > 120.0) || (x < 84.0) )
  STOPMSG("lfgt failed:  Lock Gain out of range.")
/*   y = (a+cx+exx)/(1+bx+dxx)                    */
a = 0.004789085;
b = -0.024171996;
c = 0.27679452;
d = 0.00014667775;
e = -0.0020233549;
loopfilter = (a + c*x +e*x*x)/(1.0 + b*x + d*x*x);
PUTBSMSVAL(BSN_LOOP_FILTER,loopfilter);
```

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Kalamazoo, MI 49001-0199
USA

Telephone (616) 833-4000

```
            /*      y = a + b*ln(x)                                 */
            a = 456.48626;
            b = -99.126231;
            loopgain = a + b*log(x);
            PUTBSMSVAL(BSN_LOOP_GAIN,loopgain);
            /* I hope Barry appreciates the whitespace saving */
/*      y = a + bx + cxx + d/x + e/xx                 */
a = -432.64545;
b = 2.9625609;
c = -0.0074406613;
d = 27665.636;
e = -656369.48;
looptime = a + b*x + c*x*x + d/x + e/(x*x);
PUTBSMSVAL(BSN_LOOP_TIME, looptime);
Proc_err(0, "Setting Loop Filter, Gain, and Time to: \n %5.01f
%6.11f %4.21f ",
  loopfilter, loopgain, looptime);
QUIT
```

Note that the double precision variables are necessary, due to the complex forms for some of the equations, and changing the given values for the a, b, c, d and e parameters even slightly can have a huge (bad) effect on the results. For lock gains outside the range of 120 dB to 84 dB, these equations fail badly to optimize the digital filter behavior. Having issued the above warnings, I find the program very useful in the process of getting good NMR spectra.

Sincerely yours,
Paul Fagerness
pefagern@am.pnu.com

Paul Fager

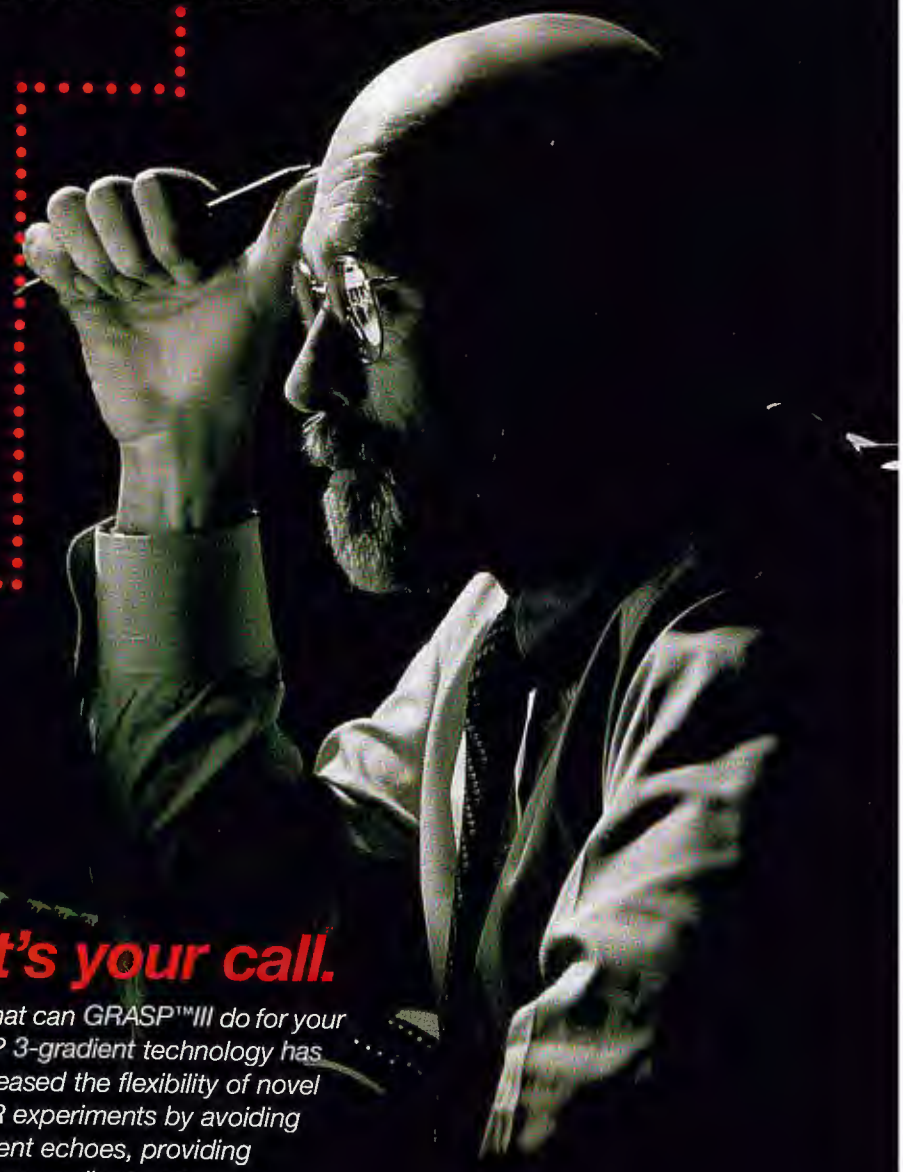
E-mail Addresses Wanted

Please include your e-mail address on all correspondence, including technical contributions, or sendme an e-mail message. This will make it more convenient - and economical - to contact you. Thanks.

BLS
shapiro@nmrnewsletter.com

Take a hard look at the difference.

Expansion of DQF-COSY with magic angle gradient, 1.5 mM BPTI in 90% H_2O/10% D_2O.



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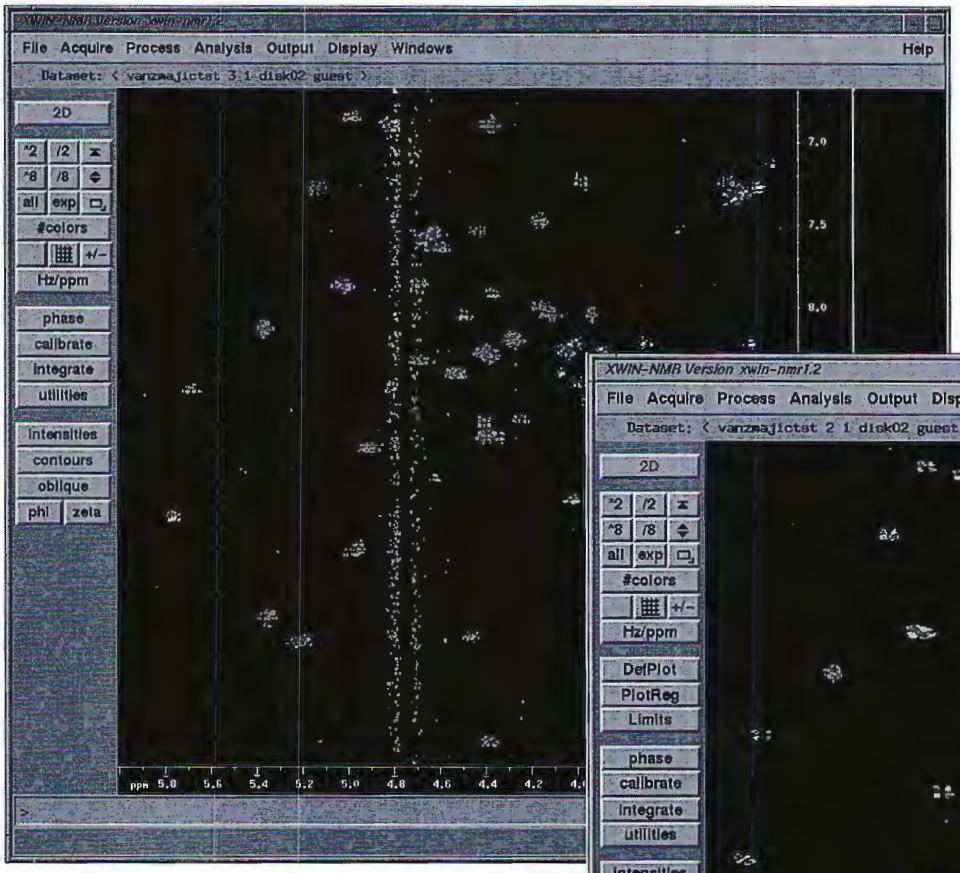
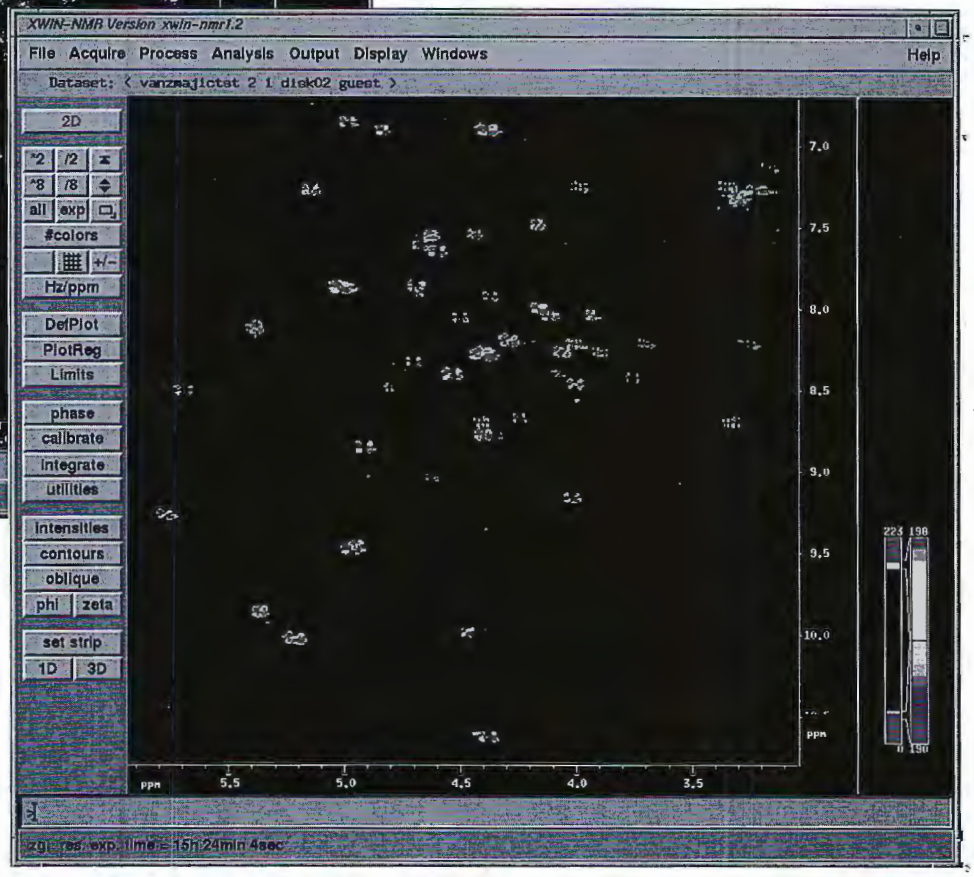
Both experiments were acquired on the Bruker AVANCE 500 equipped with a 5 mm inverse triple resonance (TXI) probe with GRASPTM-III. The sample is 1.5 mM BPTI in 90% H_2O/10% D_2O. The experiment is DQF-COSY.



Results with the z-gradient only... residual water ridge is clearly visible and overlaps crosspeaks of interest.



Results with magic angle gradient... residual water ridge is eliminated! Crosspeaks previously overlapped by the water can be observed and used for correlation assignment. The elimination of the water signal is achieved by coherence selection. No presaturation is used in either experiment!

For complete details or to arrange a demonstration please contact your nearest Bruker representative.

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(received 10/14/97)
7th October 1997

The Use of Diffusion to Study Protein Aggregation.

Dear Dr. Shapiro,

The measurement of diffusion is a very well established technique in NMR. Until lately research has been concentrated on the study of restricted diffusion. Recently though, studies have sought to relate the diffusion coefficient to the conformation and oligomeric state of proteins. The study of proteins in aqueous solution using diffusion presents a number of problems such as eddy currents which are generated by the magnetic field gradients, though the use of shielded gradients eliminated this problems. Further problems due to water suppression and gradient linearity have also been identified and remedies have been proposed (1).

This technique has many possibilities but one of the most useful many prove to be as a quick and accurate check of the state of aggregation of the protein, so that the most concentrated sample possible can be made whilst the protein remains a monomer. This technique has already been demonstrated (2) for BPTI (Bovine Pancreatic Trypsin Inhibitor) which was shown to form a monomer only at very low concentrations.

We have measured the diffusion coefficient at a range of concentrations for a domain of an SH3 (Src Homology 3) protein consisting of 63 amino acids. This domain is observed to dimerise at a concentration of approximately 1.5 mM. As can be seen in Figure 1 there is a dramatic decrease in the diffusion coefficient at concentrations above 1.5 mM which is due to dimerisation. We envisage that the method developed here could be used routinely to check the solution states of new protein systems.

References.

1. M.L. Tillett, L-Y Lian, T.J. Norwood, Journal of Magnetic Resonance (Submitted).
2. E. Ilyina, V. Roongta, H. Pan, C. Woodward and K.H. Mayo, Biochemistry 36, 3383-3388 (1997).

Yours sincerely,

Marcus Tillett Lu-yun Lian Timothy Norwood Vicky Galbraith

P.S. We hope that this contribution will revive Gordon Roberts' subscription to the NMR Newsletter.

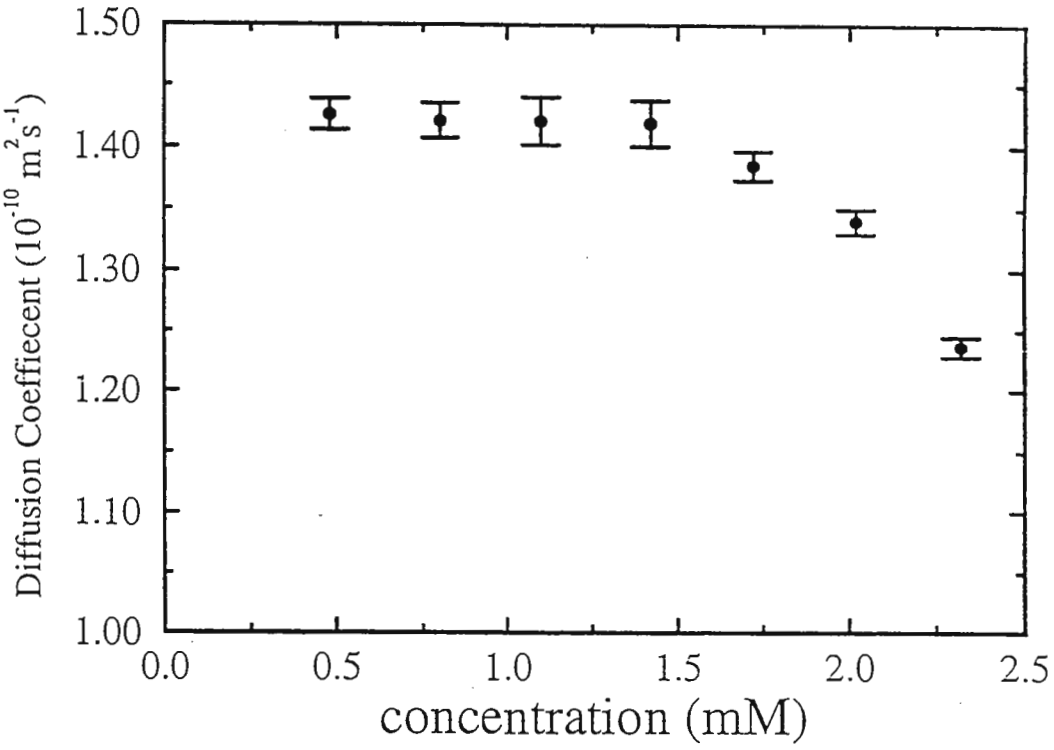

Fig. 1

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The NMR Newsletter
966 Elsinore Court
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October 6, 1997
(reçu 10/11/97)

Influence of sample heating on ^{15}N-T_2 measurements

Cher Dr. Shapiro,

Measurement of ^{15}N-T_2 relaxation data for proteins in solution requires the application of a large number of ^{15}N pulses for various relaxation decay time periods[1]. Depending on various factors such as decay time duration, power level used, delay between scans, and sample conditions, T_2 experiments are prone to sample heating. In particular, ionic strength, solvent, and γB_2 magnitude can have profound effects on sample heating[2]. Sample heating can lead to inaccurate data in two ways. First, it can directly affect the dynamic properties of the protein which are temperature dependent. Second, since each data point requires a different spin-lock period, the amount of sample heating will vary between data points and adversely affect the observed exponential decay. Care must therefore be taken to avoid or minimize sample heating.

A simple way to reduce heating is to increase the relaxation delay between scans, and we looked at the dependence of the observed T_2 on the relaxation delay. T_2 data was obtained using five different relaxation delays : 1.0, 1.5, 2.0, 2.5 and 3.0s. The precision of each of the T_2 values was estimated from the exponential fit. The accuracy of the different T_2 measurements was estimated by assuming that the data obtained with the longest relaxation delay (3.0s) gave the 'correct' T_2 ($T_{2,c}$):

$$\text{accuracy} = (1/N)\sum_{n} \Delta_{T_2} / T_{2,c}$$

where Δ_{T_2} is the absolute difference between the T_2 at a given relaxation delay and $T_{2,c}$. The average is over all 74 characterized residues (N). The relation between accuracy of the observed T_2 and the relaxation delay is shown in figure 1.

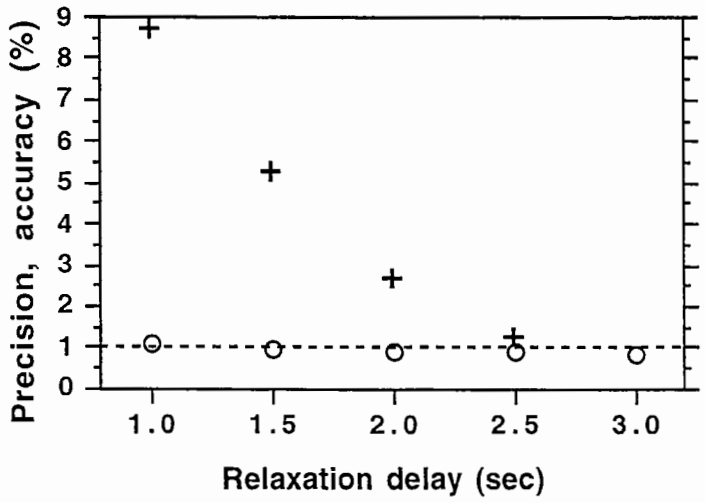

Figure 1. Effect of sample heating and length of the relaxation delay on the precision (O) and accuracy (+) of the measured ^{15}N-T_2. For each delay, the average of all 74 measured T_2 is used. Precision and accuracy were evaluated as described in the text.

Although the precision of the various T_2 is nearly constant at ~1%, the accuracy of those values is very poor when using short relaxation delays. For this sample[3] and the experimental conditions described below[4], a relaxation delay of 2.5s was necessary to obtain an accuracy of the order of ~1%. The 1.5s experiment was repeated twice, two weeks apart, and showed that the inaccuracy of 4.5% was reproducible ('precise') to 1%. These data clearly demonstrate that one can obtain inaccurate T_2, although very precise, if care is not taken to minimize sample heating. In our experience, dielectric heating of the NMR samples due to the electric component of the r.f. field is an insidious problem which is easily avoided by either choosing a long relaxation delay (~3 s) or ensuring that the relaxation delay is optimized for the conditions. A relaxation delay of 3s was used in the present study. Note that a longer relaxation delay also reduces potential problems related to partial water saturation.

[1] Farrow, N. A., Muhandiram, R., Singer, A. U., Pascal, S. M., Kay, C. M., Gish, G., Shoelson, S. E., Pawson, T., Forman-Kay, J. D. & Kay, L. E. (1994). Backbone dynamics of a free and a phosphopeptide-complexed Src homology 2 domain studied by ^{15}N NMR relaxation. *Biochemistry* **33**, 5984-6003.

[2] Wang, A. C. & Bax, A. (1993). Minimizing the effects of radio-frequency heating in multidimensional NMR experiments. *J. Biomol. NMR* **3**, 715-720.

[3] The NMR sample was prepared by dissolving 10mg of metal-free N-domain of troponin C (NTnC) in 0.5 ml of 100 mM KCl in 90% H_2O/10% D_2O. To the sample was added 5 µL of 100 mM DSS and 5 µL of 1.3% NaN_3. EDTA was also added to a concentration of 10 mM to ensure that the sample was completely in the apo form. The pH was adjusted to 6.7 with HCl and or NaOH prior to transfer to the NMR tube.

[4] ^{15}N relaxation experiments were performed at a temperature of 29.6°C on Varian UNITY Inova 500 spectrometers equipped with z-axis pulsed field gradient, triple resonance probes. The ^{15}N-T_2 experiment was performed using the pulse sequences from Farrow et al.[1] The T_2 was acquired using ^{15}N relaxation delays of [17, 33, 50, 66, 83, 99, 116, 132, 149, 165, and 182 ms]. A field strength of 3.8 kHz was used for the ^{15}N hard pulses. WALTZ-16 decoupling of ^{15}N during acquisition was performed using a field strength of 1.2 kHz. The spectral widths were 7000 and 1300 Hz for ^{1}H and ^{15}N, respectively. The acquisition times in t1 (^{15}N) and t2 (^{1}H) were 74 and 73 ms, respectively. Other various delays and gradient strengths were as described in Farrow et al.[1]

Sincèrement,

Stéphane M. Gagné Leo Spyracopoulos Brian D. Sykes

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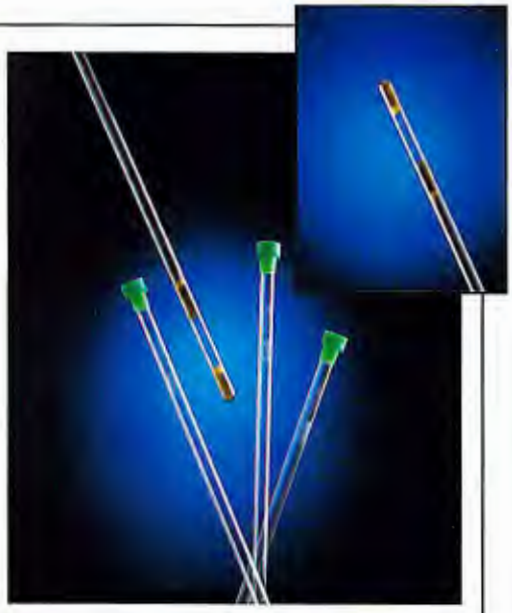

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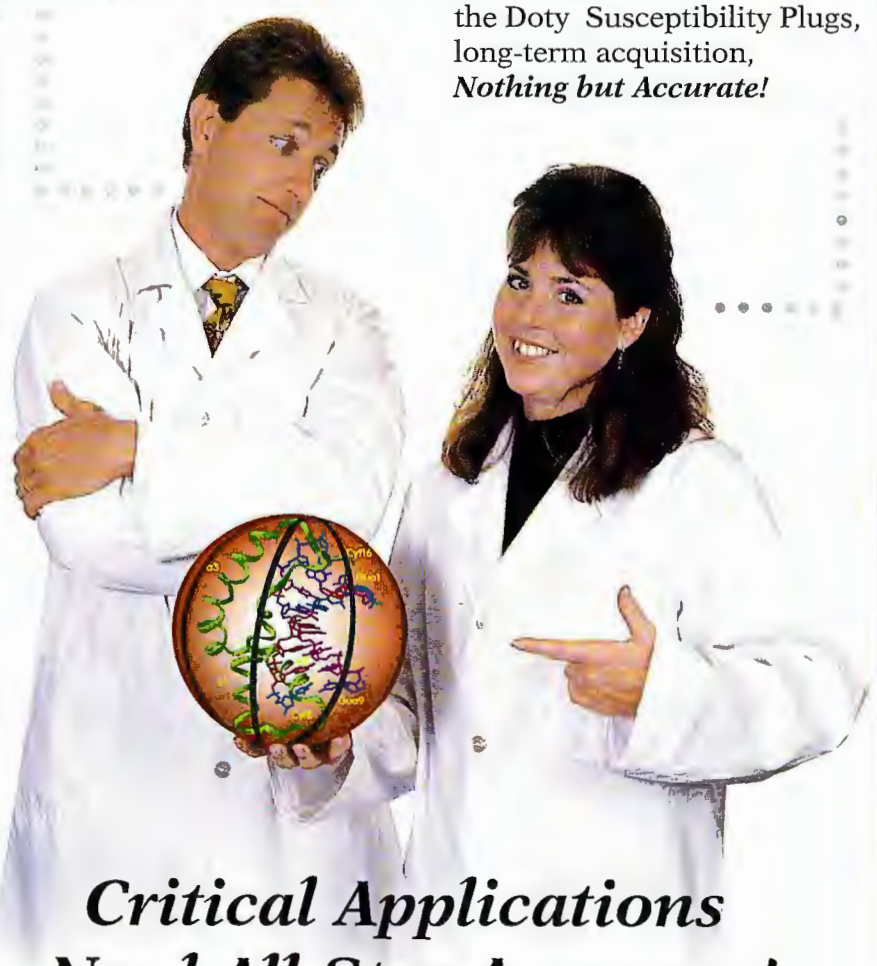

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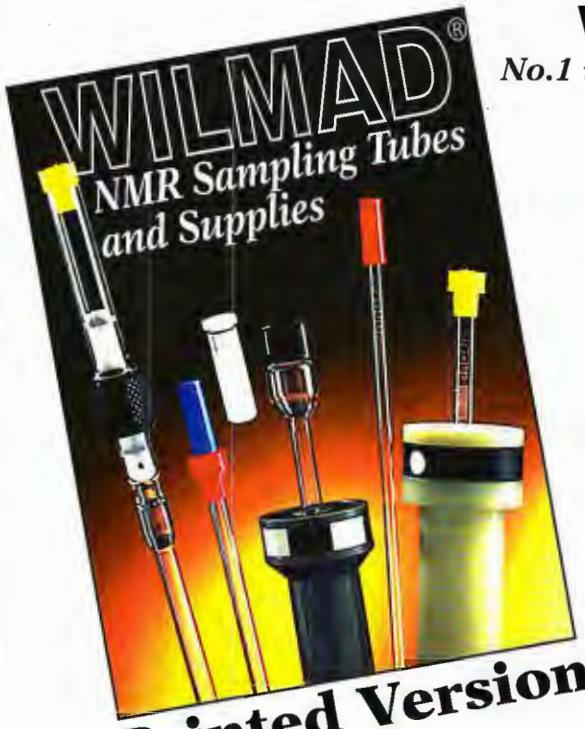

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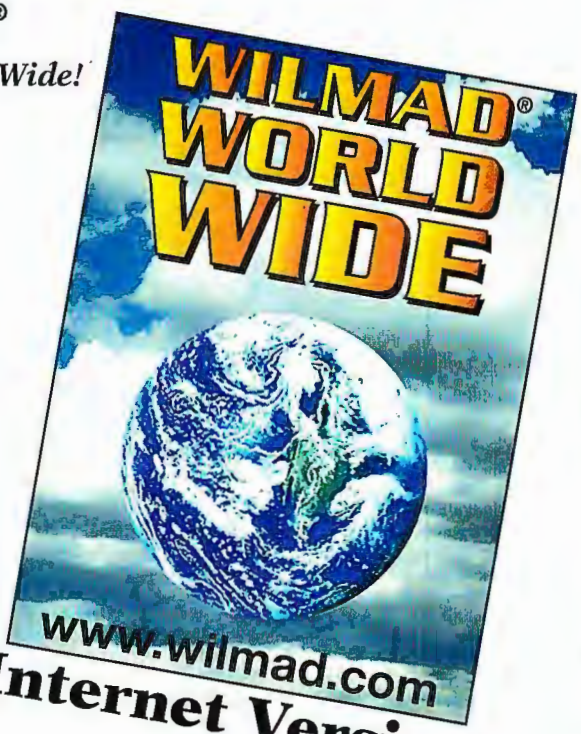

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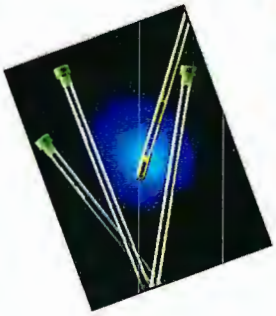

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Prof. Dr. B. L. Shapiro
The NMR Newsletter
966 Elsinore Court
Palo Alto, CAL. 94303
USA

ACCORD-HMBC

Leipzig, 12.10.97
(received 10/22/97)

Dear Barry,

You and your readers may note from the new letterhead that I have moved to the university of Leipzig. Leipzig is an exciting city in the new German East and the university has a long standing tradition in NMR.

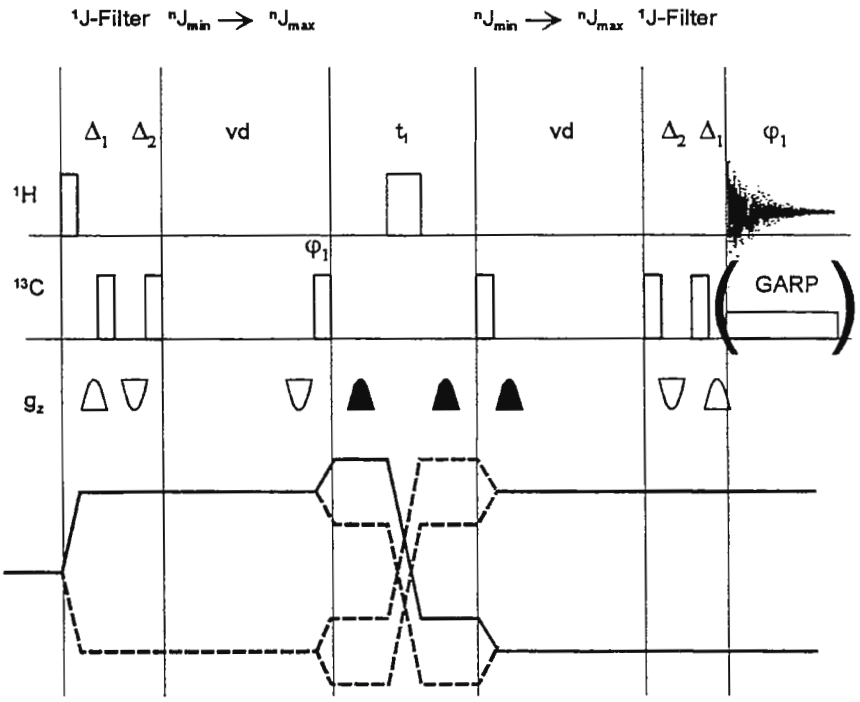
One of our last methodological efforts at Marburg was the development of a pulse sequence which we dubbed ACCORD-HMBC. It combines the ACCORDION principle [1] of Ernst and Bodenhausen with the HMBC technique. The idea is that using this principle, one is not bound to one fixed delay and can sample cross peaks from all long range C,H connectivities. Thus the HMBC polarization delay d2 is varied within the sequence spanning the range of C,H spin coupling constants from 4-20 Hz.
Another feature which we have built in the sequence is the dual stage low pass filter [2] by Soerensen, which really works very efficiently if applied twice. Since there is no more breakthrough of ^{1}J C,H cross signals ^{13}C GARP decoupling can be used, which yields an even higher sensitivity of the sequence. Of course the whole thing is gradient selected. We show in this letter the actual pulse sequence and the result for sucrose.

Sincerely yours

[R. Wagner] [S. Berger]

[1] Bodenhausen, G., Ernst, R. R., *J. Am. Chem. Soc.* **104**, 1304 (1982).

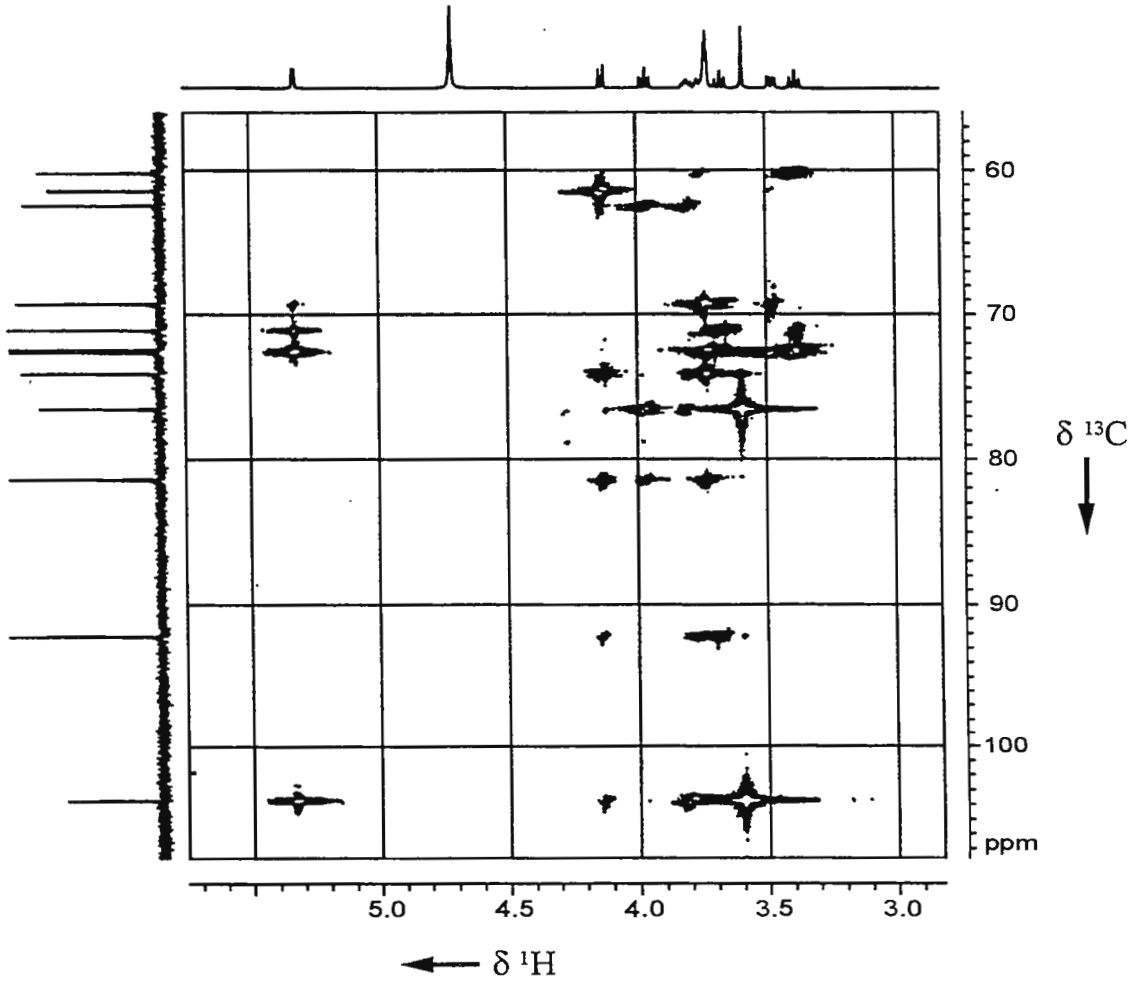
[2] Soerensen, O. W. , Nielsen, N. C., Bildsoe, H., Jakobsen, H. J., *J. Magn. Reson.* **70**, 54 (1986).



$\Delta_1 : 1 / 2 (^1J_{min} + 0.146 (^1J_{max} - {}^1J_{min}))$

$\Delta_2 : 1 / 2 (^1J_{max} - 0.146 (^1J_{max} - {}^1J_{min}))$

$\varphi 1$: x,-x



TEXAS A&M UNIVERSITY
Department of Chemistry
College Station, Texas 77843-3255
(409) 845-2011
FAX (409) 845-4719

September 11, 1997 (received 9/26/97)

Sharing Experiment Space under VnmrX

Dear Barry,

As you know, we have a fairly large number of users on the various instrument systems here at Texas A&M, and with the increasing desires/requirements for user disk space it becomes something of a problem to provide sufficient disk space for all the various user needs. Especially troublesome are the space requirements for 3D experiments.

In order to maximize the use of disk space, I have implemented a distributed resources approach. Each of the seven Sparc stations in the NMR facility has several gigabytes of disk space available, and this disk space is divided up by research group. Each disk drive has home directory space for 2 or 3 different research groups. These directories are shared, using NFS and the Solaris automount facilities, by all of the Unix computers. Thus, each user has one home directory, which is available as needed on any of the spectrometers. This eliminates the duplication of files and the problems associated with keeping track of the location of a given spectrum. Also simplifying both user administration for me, and convenience for the users, is the use of the NIS+ management tools. This package permits administration of a single password and group file, along with the various automount maps, across the entire set of workstations, eliminating problems in keeping multiple copies of the same file in sync.

While this approach maximizes the use of the available disk space, it does not solve the problem of storing very large experiments, especially since the Varian software does not have provision for creating an experiment file larger than a single disk partition. Given the limited number of SCSI addresses available on a SCSI controller card, and the finite number of S-bus slots available to add SCSI controllers, it is not practical to add sufficient disk space to let anyone run one of these large experiments. We solved this problem by adding a single large 9 gigabyte drive to the UnityPlus 500, where the 3D experiments were being performed. Instead of giving each user a portion of this large disk, I simply created two experiment files on this disk and wrote a series of scripts and macros that automatically link and unlink these experiments to a user's vnmrsys directory. This makes the large disk available for any user on the system, while he is logged on and using the system, but not available when he is logged on remotely for data processing or for operation on one of the other spectrometers. This concept could be extended by sharing the 9 Gigabyte drive, mounting it on a remote system, and then linking the experiments on that system. Our experience has been that there does not appear to be any appreciable performance penalty associated with using NFS-mounted directories for NMR

experiment files, perhaps because the acquisition processor is effectively buffered by several megabytes of HAL memory. The only issue to resolve in exporting the large drive to multiple spectrometers is in defining a protocol that permits only one user to link the experiments at any one time.

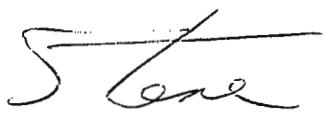
We have also extended this idea to providing for archival data storage to machines outside of the NMR facility. If a user exports a disk directory from a remote workstation, we will add that directory name to an automount table so that it is mounted under /nmrdata on any of the local systems as needed. In this way, users can have more control over the amount of disk space available to them for data storage, simply by exporting a larger disk partition. It is also possible to use this foreign-system disk space to store and link additional experiments, if desired.

While linking a single experiment to any one of several users is conceptually very simple, there are several things that need to be done to make it work properly. One issue is that of file ownership, in that VnmrX expects the experiment file to be owned by the person using it. Since only the root user can make an arbitrary change in file ownership, this posed something of a problem to implement in an automatic fashion. The obvious approach of setting the SUID mode bit on a root owned file is not normally permitted on script files under Solaris. This can only be done in a csh script using the special -b option flag. In the scripts I wrote, the file ownership command was factored out of the bourne shell script into a short csh script called /vnmr/bin/vchown, which must have the suid bit set in the permission modes. The /vnmr/bin/makelink script then calls this script to change ownership after it has created the necessary links. The unlink script has no special permission mode requirements and can be run by any user with no restrictions. This procedure is implemented by adding a shell call to the makelink script from the bootup macro, creating the links when a user logs in, and adding a shell call to the unlink script in the exit macro ot remove them when he logs out.

The other major problem that presents itself is that of defining which user has access to the linked experiments. We have addressed this by permitting access to these experiments only to the user who is logged on to the system console and presumably in a position to collect a large data set. The obvious problem with this approach is that it may be a problem to find sufficient time to process and manipulate this data after it is collected. Local practice however is to use 3rd party software on remote systems for data processing. With a remote directory automounted under /nmrdata, it becomes trivial to save a data set directly to the remote machine for further processing.

Copies of the scripts and macros involved, along with more detailed information on their operation, are available in the software section of our web site at http://wwwchem.tamu.edu/services/NMR. The implementation is straight forward and should not require extensive modifications to work on other Varian systems.

Best Regards,



Steven K. Silber

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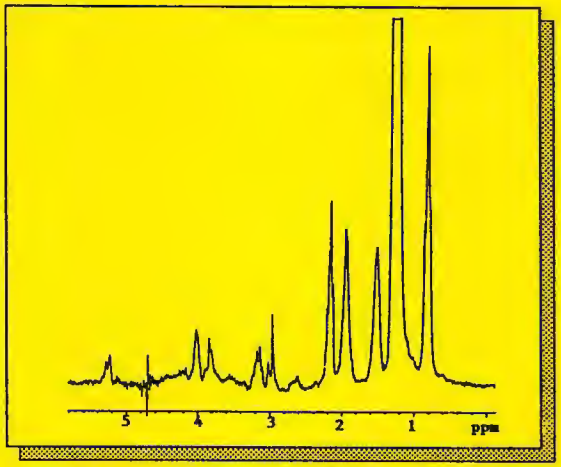

^{1}H HR Fast MAS, Ground Beef at 14 kHz. 300 MHz, nt=16, 70 μL, min. LW~5 Hz. Low thermal gradients and centrifugation.

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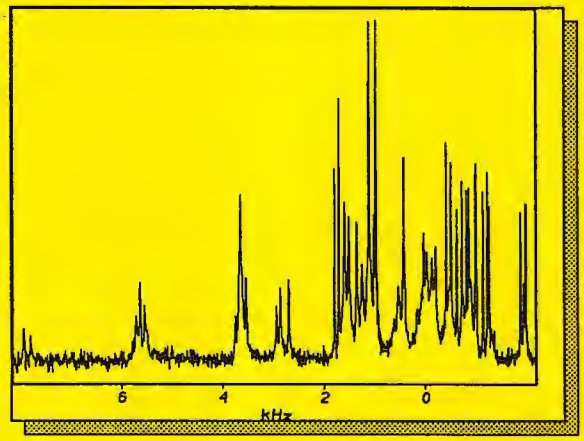
REDOR Probes	Rotor dia./speed	Lineshape ^{1}H Hz	Thermal Grad.	VAS	S/N,*nt=4 (500 WB)
Doty	5 mm, 19 kHz	3/30/60	1.2°C	Yes	>400
Vendor 2	4 mm, 15 kHz	~8/300/600†	~30°C	No	~150†
Vendor 3	2.5 mm, 35 kHz	?	~30°C	No	~30†

*HMB, CP. †Estimates based on available, related data.



Above: Cholesterol Acetate, ^{1}H-^{13}C CPMAS, WB 500 Mhz , 64 scans in 5-mm REDOR probe. 90 kHz ^{1}H decoupling for 51 ms, 50 kHz CP for 4ms, LB=0. 40+ resonances appear resolved. Spectra courtesy of K. Zilm and B. Tounge, Yale.

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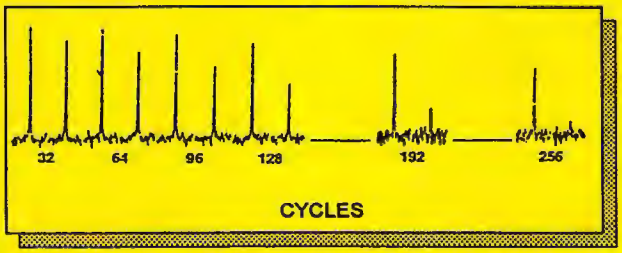

Above: WHWLQLKPGOPNLeY REDOR, 300 MHz WB, 95 kHz 1H during evolution. ^{13}C π pulses on alternate cycles. Spectra courtesy of Ruth Stark, CUNY, College of Staten Island

DEPARTMENT OF CHEMISTRY
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Queen's University
Kingston, Canada
K7L 3N6

NMR at Queen's University

(received 10/8/97)
Oct 7, 1997

Dear Barry,

With this communication we would like to initiate our subscription to the NMR Newsletter. To that end we would like to briefly describe the instrumentation situation (and hopes) and conclude with some specific overviews of two areas of personal interest, solids NMR and new methods of data analysis in complex systems.

The department itself is currently equipped with an ACF200, an AM400 and a CXP200. Earlier this year we initiated a program to ensure that offline NMR processing is available to all, which has included the purchase of an Acorn NMR NUTS site license (which I think has proven to be very successful) and the installation of an SGI O2 workstation as a server for the NMR users in the department. Eventually all users should have seamless access to both PC and UNIX-based software and related NMR utilities. I should note that the user base is of the order of 100-120 persons at the moment, including faculty, graduate students, post-docs and some outside industrial users. Various processes are in the works that should ensure that NMR use/capabilities increase significantly. The 18- year old CXP200 (still running after all these years with a magnet that has never quenched and never been pumped down...is this a record?) will become a TECMAG /Bruker hybrid instrument some time this fall with the replacement of the original console with an Apollo console with related all digital electronics. In the 'hopes' category we are now looking at 500+ MHz instrumentation to complement/replace existing instrumentation.

With respect to the solids situation Dr. Gang Wu has recently joined the faculty and will be involved in the development of the NMR of quadrupolar nuclei in the solid state. Our primary research interests are concerned with the development of novel solid-state NMR techniques in studying molecular structure, dynamics, and chemical bonding in chemical and biological systems. Currently, we are focused on the development and application of solid-state quadrupolar NMR with the emphasis on probing metal ion environments in biological systems including naturally occurring and synthetic cation-transport antibiotics, metalloproteins, nucleic acids and biomimetic models. A large number of biologically important nuclei such as ^{17}O, ^{23}Na, ^{43}Ca, and ^{67}Zn are quadrupolar (*i.e.*, their spin numbers are greater than 1/2), and are difficult to study in solution media where rapid quadrupole relaxation times often lead to broad NMR lines. In contrast, molecular motions are significantly restricted in solids resulting in rather long relaxation times. This permits the possibility of obtaining high-resolution NMR spectra for quadrupolar nuclei in solids. However, to develop solid-state NMR techniques that can yield high-resolution spectra for quadrupolar nuclei has been a challenging problem in the field for many years.

An important breakthrough was made in 1995 by Frydman and co-workers with the invention of multiple-quantum magic-angle-spinning (MQMAS) NMR spectroscopy [1,2]. We have been actively involved in this new exciting frontier of solid-state NMR [3-6]. For example, we were able to obtain ^{17}O triple-quantum MAS spectra from a typical crystalline hydrate, $Ba(ClO_3)_2 \cdot H_2{}^{17}O$, which has a large ^{17}O quadrupole coupling constant, $e^2qQ/h = 6.8$ MHz [6]. It is seen from Figure 1 that the resolution in the ^{17}O MQMAS spectrum is approximately 150- and 500-fold higher than found in the MAS and static spectra, respectively. We are currently applying this new technique to study metal ion binding to biomolecules.

In other areas my interests have encompassed the application of neural networks and multivariate (principal component) image analysis to more complex NMR-related problems spanning time domain, solution, solid state and imaging applications. For instance, Y. Hiltunen, E. Heiniemi, and M.Ala-Korpela, (J. Magn. Reson. B106, 191 (1995)) first reported quantitative neural network analysis of NMR spectroscopic data of lipoproteins. Neural network were trained to relate part of the ^1H spectra of plasma samples to lipoprotein lipid values obtained by biochemical assays. ^1H NMR spectroscopy was used to quantify lipoprotein lipids

directly from plasma samples with no pretreatment and no isolation or decomposition of lipoprotein particles. The method does not require fasting samples and samples are not destroyed. We can use lipoprotein lipid methyl and methine resonance regions to derive absolute concentrations of VLDL (very low density lipoprotein), LDL(low density lipoprotein) and HDL (high density lipoprotein) and IDL (intermediate density lipoprotein) as well as selected apo-lipoprotein species. Table 1 illustrates some results. For the training data sets correlation coefficients are quite high (although this is not necessarily the best or optimum variable on which to base goodness of fit in these applications). Similarly, most test data sets (i.e., predicted values using NMR data that the networks had never seen before) exhibited high correlation coefficients. In those instances where the more traditional backpropagation feed forward neural networks have proven to be inadequate, we have successfully investigated the application of other methods /topologies (general regression neural networks, polynomial nets). The lesson here is that in complex data sets involving significant non-linear relationships for which we have little prior knowledge (or even understanding) one can quite successfully devise realistic and useful predictive models.

Similarly, these methods are (successfully) being applied to correlate solid state ^{13}C NMR analyses of food (cattle feed) to metabolism in animals, solid state NMR relaxation times in polymer systems as related to properties in pharmaceutical products, classification of breast cancer tumors from both dynamic contrast magnetic resonance imaging studies and in-vivo MRS (i.e.non-invasive) spectroscopic studies of tumors from which classifications and models can be derived...again all studies related in some way to the application of neural networks.

References

[1] L. Frydman and J. S. Harwood, *J. Am. Chem. Soc.* **117**, 5367(1995).
[2] A. Medek, J. S. Harwood, and L. Frydman, *J. Am. Chem. Soc.* **117**, 12779(1995).
[3] G. Wu, D. Rovnyak, B. Q. Sun, and R. G. Griffin, *Chem. Phys. Lett.* **249**, 210(1996).
[4] G. Wu, D. Rovnyak, and R. G. Griffin, *J. Am. Chem. Soc.* **118**, 9326(1996).
[5] G. Wu, S. Kroeker, R. E. Wasylishen, and R. G. Griffin, *J. Magn. Reson.* **124**, 237(1997).
[6] G. Wu, D. Rovnyak, P. C. Huang, and R. G. Griffin, *Chem. Phys. Lett.* (in press)

David Axelson

Sue Blake

Table 1 Neural Network Analysis Results

TRAINING DATA:

Variable	Std Dev	Max Error	Correlation Coeff.
1	0.043	0.103	0.992
2	0.021	0.050	0.985
3	0.172	0.419	0.979
4	0.047	0.113	0.988
5	0.080	0.155	0.987
6	0.016	0.038	0.936
7	0.021	0.054	0.988
8	0.007	0.024	0.986
9	0.026	0.083	0.994
10	0.049	0.121	0.973
11	0.058	0.146	0.986
12	0.068	0.182	0.987

TEST DATA:

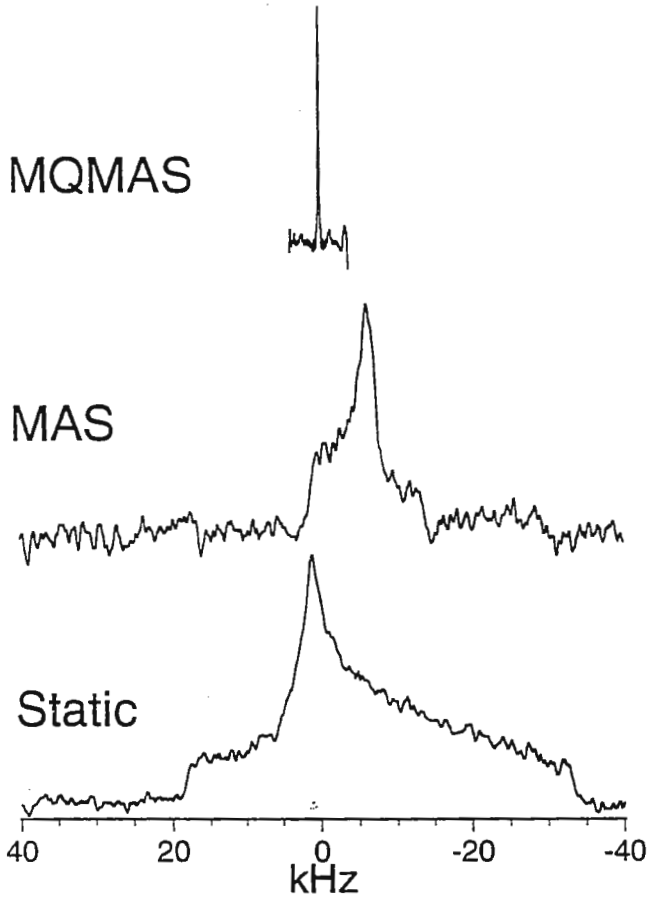
Variable	Std Dev	Max Error	Correlation
1	0.299	0.726	0.971
2	0.092	0.184	0.932
3	1.450	4.722	0.587
4	0.286	0.562	0.759
5	0.658	1.387	0.961
6	0.069	0.218	0.807
7	0.134	0.402	0.867
8	0.056	0.094	0.162
9	0.188	0.415	0.794
10	0.381	1.258	0.626
11	0.434	1.408	0.843
12	0.385	0.737	0.593

Variables:
1 VLDL_chol, 2. IDL_chol, 3. LDL_chol, 4. HDL_chol, 5. VLDL_tg, 6. IDL_tg, 7. LDL_tg, 8. HDL_tg, 9. LDL_ApoA1, 10. LDL_ApoB, 11. plasma_ApoB, 12. plasma_ApoA1, where chol= cholesterol, tg=triglycerides

Coworkers on these projects include: Prof Jostein Krane, NTNU, Trondheim, Norway and Ingrid S. Gribbestad, SINTEF Unimed, Trondheim, Norway.

On the following page we summarize the figures.

Figure 1(top) ^{17}O NMR spectra of a solid sample of $Ba(ClO_3)_2 \cdot H_2{}^{17}O$ (with 50% ^{17}O enrichment) obtained at 9.4 T. The sample spinning frequency was 19.8 kHz in both the MAS and MQMAS experiments; (bottom) 500 MHz ^1H NMR spectrum of human blood plasma showing high field region of interest used in analyses.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MAS
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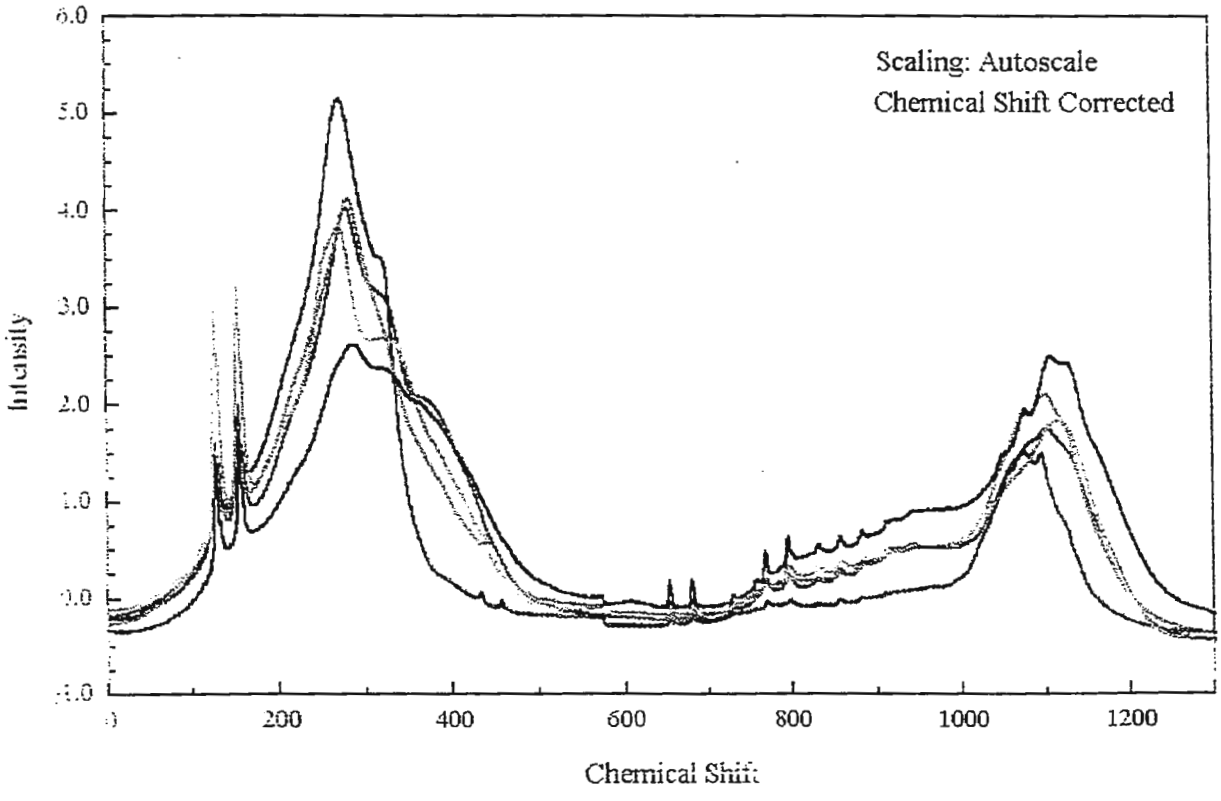
20
0
-20
-40
kHz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Chemical Shift Corrected
Intensity
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5.0
4.0
3.0
2.0
1.0
0.0
-1.0
0
200
400
600
800
1000
1200
Chemical Shift

TECHNICAL SUPPORT POSITION IN SOLID STATE NMR

A position is available in the Laboratory of Chemical Physics, National Institutes of Health in Bethesda, Maryland, to provide scientific and technical support in the research group of Dr. Robert Tycko. Research in Dr. Tycko's group centers on the development of solid state nuclear magnetic resonance (NMR) and optically-pumped NMR techniques for structural studies of biopolymers, and on the application of these techniques to problems in biophysics and structural biology. Responsibilities include the maintenance and operation of solid state NMR spectrometers, the configuration and upkeep of computer systems, and the design and fabrication of novel experimental apparati. Applicants should have a bachelor's or master's degree in physical science or engineering, experience with electronics and other complex scientific equipment, and good computer skills. Applicants with more advanced degrees or additional experience are welcome. The appointment will be at the GS-7 or GS-9 level, depending on qualifications. Interested parties should contact Dr. Tycko by e-mail (tycko@helix.nih.gov) as soon as possible for further details.

Position Available

THE UNIVERSITY OF MISSOURI-ROLLA, DEPARTMENT OF CHEMISTRY, invites applications from individuals with expertise to oversee all aspects of its NMR facility operation, maintenance, training and related academic course activity. The successful candidate will also participate in the oversight of departmental utility development projects. Ph.D. degree in Chemistry or Physics is required with a strong background in both solution and solid state NMR. Send applications with vitae to Dr. Harvest Collier, Interim Chair, Department of Chemistry, University of Missouri-Rolla, Rolla, MO 65409-0010. Review of applications will begin November 1, 1997 and continue until the position is filled. UMR is an AA/EO employer.

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Please direct all inquiries to Dr. Nico Tjandra
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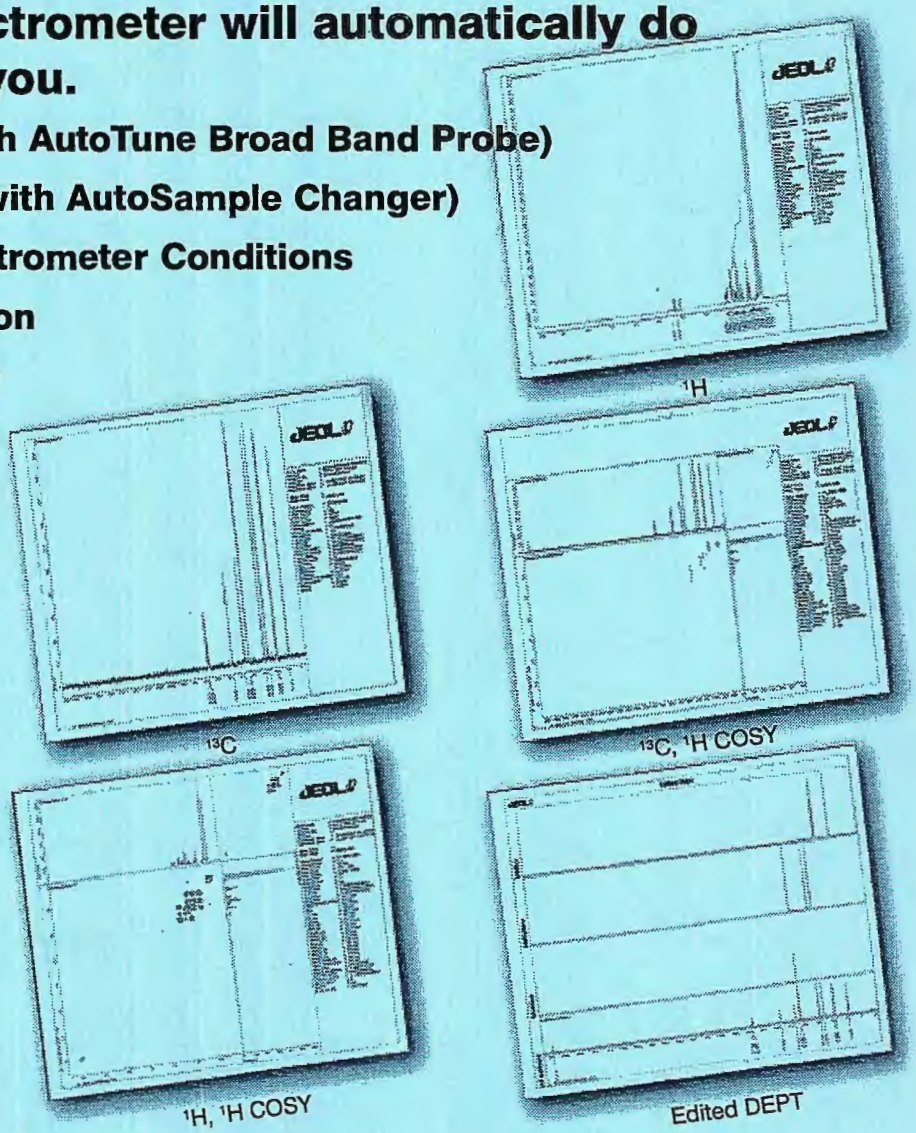

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