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2008
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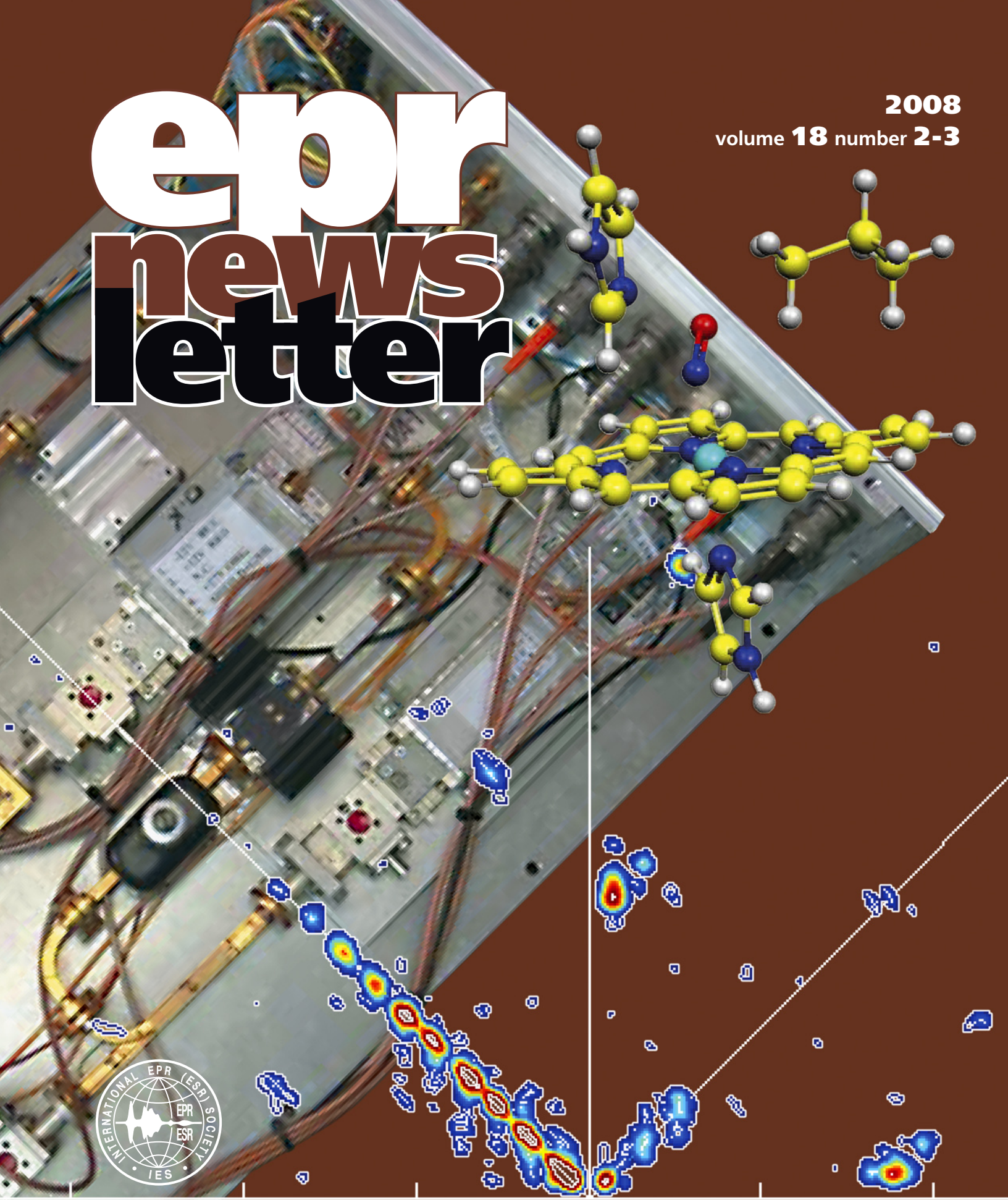

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Please feel free to contact us with items (news, notices, technical notes, and comments) or ideas for the *EPR newsletter*.
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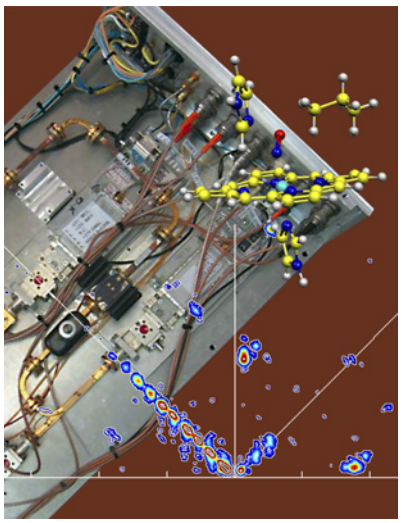

The cover picture illustrates some of the current research carried out by Daniella Goldfarb, recipient of the 2007 Bruker Prize. The structure and spectrum in the foreground show the crystal structure of the NO bound heme center of myoglobin and its HYSCORE spectrum obtained with $\pi/2$ pulses of 12.5 ns and a π pulse of 25 ns. The picture in the background shows the new 95 GHz microwave bridge in Daniella Goldfarb's lab that features such short pulses.

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The Publication of the International EPR (ESR) Society

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continued on page 2

ETH
Eidgenössische Technische Hochschule Zürich
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Editorial

Dear colleagues,

I wonder if you, as kids, were fascinated with historical novels by Alexandre Dumas, père. If yes, you certainly read about breathtaking adventures of D'Artagnan in *The Three Musketeers*. I bet it was as gripping to read its sequel, *Twenty Years After*. It was extremely exciting to meet inseparable friends D'Artagnan, Athos, Porthos and Aramis again. These were my thoughts when collecting material for the "Anniversaries" column in the present issue. In the *EPR newsletter* 13/3, pp. 12–15 (2003) we warmly congratulated Yurii D. Tsvetkov and Robert Blinc on their 70th birthdays, Jack H. Freed on his 65th birthday, Klaus-Peter Dinse and Wayne L. Hubbell on their 60th birthdays, and presented details of their life and research. Now, five years later, how should we celebrate their "plus 5" birthdays in addition to wishing them all the best on this occasion? I thought it might be good to introduce a sequel, a "Five Years After" column so that we meet them again, and addressed Yurii, Robert, Jack, Klaus-Peter and Wayne with a request to give an interview to the *EPR newsletter*. You are welcome to Jack's and Wayne's interviews (p. 22). I am sure you will share with me the wonderful feeling of getting one step closer to understanding the depth of their personalities and you will also be looking forward to meeting other greats already featured in the "Anniversaries" column in the future issues. I am grateful to Jack and Wayne and I am glad that these outstanding scientists started the "Five Years After" column with their contributions.

Cairns, Australia and Breckenridge, Colorado, USA are places that provided the main news for this issue. The minutes of the IES Annual meeting 2008 (p. 3) summarize the activities of the IES and introduce you to new CEOs: Jack Freed, Michael Bowman, Michael Davies, Thomas Prisner, Sushil Misra, and Tatyana Smirnova. Heartfelt thanks to all of our former CEO's: Wolfgang Lubitz, Balaraman Kalyanaraman, Shozo Tero-Kubota, Carlo Corvaja, Shirley Fairhurst, and Chris Felix. For those who do not like changes, I have good news: the team of the *EPR newsletter* remains intact! I was asked to continue as Editor which I accepted, and I am happy that Candice, Hitoshi and Thomas agreed to continue as Associate Editors. I know that you greatly appreciate the professional layout of the newsletter. This is due to Sergei, our Technical Editor's taste for harmony in color and proportion who continues as well.

For the first time the IES Annual meeting took place in Australia, at the 6th Asia-Pacific EPR Conference (p. 33). The magic of the world "down under" with its luxurious vegetation and unique creatures you can see only there, was overwhelming. John Pilbrow is in the center of the "Australian/Cairns" part of the newsletter: we heartily congratulate him on his 70th birthday (p. 13) and are absorbed in reading his comprehensive story about the history of EPR in Australia (p. 24). A special treat for you from "down under" is the *Olympic Fever* article by John Boas in the "Another Passion" column (p. 10) which fits so nicely with the 2008 Beijing Olympics festivities. Enjoy!

Sandy and Gareth Eaton make news in the "American/Breckenridge" part of this issue: the thrilling story about the 30 years of the Denver ESR Symposium (p. 17) and the instructive article on quantitative EPR (in co-authorship with Dave Barr) in the "Tips and Techniques" column (p. 32).

Talking of the "Tips and Techniques" column, I have good news to share: Keith Earle and David Budil agreed to serve as its co-editors! But this is not all the good news: Stefan Stoll agreed to edit the "Software" column! Frankly, these two columns with no articles in them made me very nervous. Now I feel relaxed and peaceful: Keith, Dave and Stefan are people we can rely on. To update you, an initiative by Wayne Hubbell to cover the IES membership dues for his young collaborators mentioned in my editorial of 17/2-3 was not neglected and found response and supporters in the EPR community. Please feel free to follow Wayne's initiative.

With this flow of good news I can finish my last editorial of 2008. Happy New Year to you, our dear readers! I wish you all the best! To remind you, 2009 marks the 20th anniversary of the IES. Your ideas on how to celebrate this event are most welcome! But it is a special story… talk to you in the forthcoming issue of EPR newsletter…

Laila Mosina

IES Annual Meeting 2008

Held at the Asia-Pacific EPR/ESR Symposium (APES2008), Cairns, Australia on 17 July 2008.
The meeting was opened and chaired by the President of the Society, Wolfgang Lubitz and opened at 18:00.

The agenda of the meeting and minutes of the AGM 2007 were distributed to those present, along with the attendance sheet and membership forms by Sushil K. Misra. (Everyone was invited to attend the meeting even if he/she was not a member of IES). Thanks to Sushil K. Misra for taking notes on behalf of Shirley Fairhurst, Secretary IES.

1. Attendance and Apologies

Attendance (48): Toshaki Arata, Elena Bagryanskaya, Simon Benson, Lawrence J. Berliner, S. V. Bhat, John Boas, Prem Chand, Peter Comba, Michael Davies, Klaus-Peter Dinse, Simon Drew, Sergei Dzuba, Betty Gaffney, Masayuki Hagiwara, Graeme Hanson, Howard Halpern, Hiroshi Hirata, Chris Jones, Takanari Kashiwagi, Valery Khramtsov, Asako Kawamori, Candice Klug, Peter Lay, Wolfgang Lubitz, Allan McKinley, Roger McMurtrie, Hiroyuki Mino, Jacek Michalik, Sushil Misra, Laila Mosina, Toshikazu Nakamura, Shigeaki Nakazawa, Chris Noble, Vasily Oganesyan, Hitoshi Ohta, John Pilbrow, Boris Rakvin, Edward Reijerse, Czeslaw Rudowicz, Kazunobu Sato, Alex Shames, Alex Smirnov, Graham Smith, Sarah Smith, Takeji Takui, Hideo Utsumi, Johan van Tol, Seigo Yamauchi.
Apologies: Carlo Corvaja, Shirley Fairhurst, Chris Felix, Balaraman Kalyanaraman and Shozo Tero-Kubota.

2. 2007 Minutes

The minutes of the General Meeting held on the 26th March 2007 were presented and accepted as a true record of the previous meeting.

3. President's Report

Dear Colleagues,

On behalf of the IES Executive Committee, I wish to welcome all participants to the 2008 General Meeting of the IES and the APES2008 Conference in Cairns. I would like to express my gratitude to the organizers of this meeting, in particular Prof. Hanson, for allowing our General Meeting to take place during this Conference and for providing time in the program to present the 2008 Silver Medal for Instrumentation to Prof. Hitoshi Ohta in a special session.

This is the second time – after Oxford (UK) last year – that we have our General Meeting outside the USA, with the aim to reflect the worldwide membership of the Society.

We are here to tell you about our work over the past year but also to hear your views.

- During the last year I represented the IES at the following EPR meetings and conferences:
  - The 40th RSC EPR group meeting in Oxford, UK, April 2007
  - 11th Chianti Workshop on Magnetic Resonance in Vallombrosa (Florence), Italy, May 2007
  - The 7th Voevodsky Conference in Chernogolovka, Russian Federation, July 2007
  - The EPR Conference (100 Anniversary Zavoisky) in Kazan, Russian Federation, September 2007
  - The ISESS-SEST 2007 Conference in Shizuoka, Japan, November 2007
  - The 41th RSC EPR group meeting in London, UK, April 2008
  - APES2008 Symposium, Cairns, Australia, July 2008
- During the last year the IES has worked successfully
  - to stabilize the financial situation of the Society (see later)
  - to search for and elect a new Executive
  - to recruit new members (e.g. via EPR centres sponsoring their students membership)
  - to help to install new chairs or fill vacant chairs related to EPR spectroscopy and EPR groups worldwide
- **IES Awards 2008**:
  - Gold Medal to Prof. Jan Schmidt will be presented by the president at the COST P15 EPR meeting in Siena, Italy, September 2008
  - Silver Medal (Instrumentation) to Prof. Hitoshi Ohta has been presented by the president at the APES2008 conference, Cairns, Australia, July 2008
  - Prof. Sandra Eaton & Prof. Gareth Eaton will receive the Fellowship of the Society at the EPR Symposium from the IES Treasurer in Breckenridge, USA, July 2008

I want to thank all the members of the Medal Committees for their excellent work for the Society and the former President and the Vice Presidents for their very much appreciated support and help!

- **Meetings and Conferences**

July 7–31, 2008: 50th Annual Rocky Mountain Conference on Analytical Chemistry, Breckenridge, Colorado, USA
www.rockychem.com

Aug 22 – Sep 01, 2008: 4th EFEPR Summer School, COST P15 Training School and SUSSP 64, St Andrews, Scotland
www.st-andrews.ac.uk/~eprschool

September 07–11, 2008: SPIN 2008, 5th International Conference on Nitroxide Radicals, Ancona, Italy
spin-2008@univpm.it
www.ing.univpm.it/SPIN2008

September 24–26, 2008: COST P15 4th Joint Meeting: Advanced EPR Methods in Molecular Biophysics, Siena, Italy

Sep 29 – Oct 4, 2008: Modern Developments of Magnetic Resonance & Zavoisky Award Ceremony (Zavoisky award 2008 to Michael Mehring, Stuttgart, Germany), Kazan, Russian Federation

April 19–23, 2009: 42nd EPR Meeting, ESR Group of the Royal Society of Chemistry, Norwich, UK
www.esr-group.org.uk

This list can also be found on the website www.ieprs.org.

Please add to the list (send information to the IES Secretary or to the Newsletter Editor Laila Mosina).

4. Secretary's Report

- **IES Awards 2009. Call for Nominations**

Nominations are invited for the following awards: Silver Medal (Biology/Medicine), Silver Medal (Chemistry), Young Investigator Medal and Fellow of the Society (visit www.ieprs.org for full constitution and by-laws).

Send nominations to the IES President. Closing date: 15st November 2008.

• **IES Executive Elections 2008**

In October 2008 the current IES Executive's three-year term of office will end. Nominations were sought for the following posts and the following are nominated by the Executive:

President: Jack Freed (USA)

Vice-President Americas: Michael Bowman (USA)

Vice-President Asia-Pacific: Michael Davies (Australia)

Vice-President Europe: Thomas Prisner (Germany)

Secretary: Sushil Misra (Canada)

Treasurer: Tatyana Smirnova (USA)

As no other nominations were received the above are duly elected.

Newsletter Editor: Laila Mosina (Russian Federation)

The President re-iterated the concern expressed at the 2007 AGM that some current members of Executive should continue in the next term, otherwise it will be a new Executive, with no continuity. This year all members changed as both Secretary and Treasurer left the Executive. The constitution allows the Secretary and Treasurer to stand for 3 terms. Also, it turns out that this time the President, Secretary and Treasurer will be from North America.

5. Treasurer's Report

• Note from the Treasurer:

For several years we have been behind with our billing to sponsors and members. This situation has now been corrected with timely bills and membership dues reminders.

We now have a relatively secure financial position and have achieved our goal of having the financial buffer of a year of funding in the "bank".

We still need members to pay their dues on time and also to increase our membership levels.

Membership fees are unchanged at:

Full	$30
Emeritus/retired	$10
Postdoctoral (3 years max)	$10
Student	$5

Membership forms are included in the handouts or join via the website:

www.ieprs.org.

A series of screen shots was shown (see Newsletter article on using the IES website members pages) on how to login to the Society's web site. Members can check whether their membership is current, pay for past and future years and also change their personal details.

2007 Financial Report ($) (unaudited)

Balance January 1, 2007	3,044.50
Income:	
Total Income	18,837.14
Expenses:	
Bank & credit card fees	762.84
Web design & fees	263.40
Newsletter	9,950.00
Awards	150.00
State of Illinois	8.00
Total Expences	11,134.24
Balance December, 31, 2007	10,747.40

• Comments from meeting:

Membership dues from other countries: Regional treasurers able to collect, as outlined in the constitution of IES. (S. V. Bhat mentioned that Dr. P. T. Monoharan did that in India).

There was some discussion about national and international fees, and members with low income from some countries cannot pay $30. A model was proposed that members from developing countries pay $5 only. Finally it was commented that the treasurer can waive a membership due.

John Pilbrow suggested that the incoming Executive look at the fee structure.

The membership fee was raised in the past by J. Pilbrow from $25 to $30. The current Executive is against raising membership dues. It was suggested that instead of raising the membership dues one should strive to raise money by ads in the EPR newsletter and by seeking additional sponsors. A certain amount of money is used each year to provide the Award medals, but no monies are awarded apart from support for the Young Investigator, up to a maximum of $500, to attend a conference to receive their medal. S. Misra commented that every effort should be made to recruit new members and to collect dues.

• Note from the Treasurer:

In the past dues were collected by Regional Treasurers. This situation ceased when credit card payment on our secure website was established. The only active Regional Treasurer is Dr. Mikhail Falin in Kazan, Russian Federation. Dr. Monoharan no longer acts as a Regional Treasurer for the IES. Currently, $5 payment for members of developing countries is possible, both via the website and by the member contacting the treasurer.

6. Newsletter Editor's Report

Since the previous Annual Meeting of the IES in 2007 in Oxford we published three single issues, 16/4, 17/1 and 17/4, and a double issue 17/2-3. We hope all of you had a look at them on the newsletter website and got copies as well.

A preview of the latest issue 18/1, a public issue, was presented. By now it is already on the newsletter website as well.

On behalf of the Editorial Board, I thank most heartily all contributors to the EPR newsletter with special thanks going to the CEOs of the IES and editors of the columns in the EPR newsletter: Shirley Fairhurst, John Pilbrow, Candice Klug and Thomas Prisner, and also to Patrick Lèger and Besnik Kasumaj, our web-masters, and Sergei Akhmin, our Technical Editor. It is great that Gunnar Jeschke continues hosting the newsletter website at ETH. Gunnar, vielen Dank!

I gratefully acknowledge collaboration with Associate Editors Candice Klug, Hitoshi Ohta and Thomas Prisner.

7. Thanks

The IES thanks the following Corporate Sponsors for their contributions in 2007-2008:

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Resonance Instruments

Thanks to all paid up members
Newsletter Editor: Laila Mosina
Technical Editor: Sergei Akhmin
Associate Editors: Thomas Prisner, Candice Klug and Hitoshi Ohta

Special thanks to ETH Zurich for hosting the Newsletter website and the Zavoisky Physical-Technical Institute, Kazan for supporting the Newsletter

8. Any Other Business

It was moved by J. Pilbrow and seconded by C. Rudowicz that we thank L. Mosina for her excellent work as the Editor of EPR Newsletter – carried.

It was moved by J. Pilbrow, seconded by S. Misra that we thank the current Executive for all their efforts to serve the IES – carried.

The meeting was closed at 19:30.

New IES Executives

Jack Freed, IES President

Jack Freed was born in New York City in 1938. He graduated from Yale University in 1958 and received his PhD in Chemical Physics in 1962. After a Postdoctoral year at Cambridge University, he accepted a faculty position at Cornell University in 1963. He is the Frank and Robert Laughlin Professor of Physical Chemistry at Cornell and the Director of ACERT (National Biomedical Center for Advanced ESR Studies).

For many years he has been carrying on extensive theoretical and experimental ESR studies to probe the structure and dynamics of complex fluids (such as liquid crystals), model and biological membranes, polymers and proteins. He is well-known for his rigorous theories of lineshapes and spin relaxation for both cw and pulsed ESR spectroscopy, especially those based on the stochastic Liouville equation. In the course of these studies he and his group have pioneered and developed 2D-Fourier Transform ESR, the analogue of 2D-NMR exchange spectroscopy, and quasi-optical methods at millimeter waves for ESR at high frequencies. He and his group have pioneered the method of double-quantum-coherence (DQC)-ESR for determining protein structures by means of 10–80Å distance measurements. And, he has been developing the emerging field of ESR microscopy to provide micron resolution for biomedical and materials studies. His current research activities include the further development and applications of these powerful ESR methodologies.

His long career has brought many honors. He is a Fellow of the American Physical Society (1976) and of the American Academy of Arts and Sciences (1994). He has served on many journal editorial boards and is currently an Associate Editor of the *Journal of Magnetic Resonance*. Among his awards are the Buck-Whitney Award in Pure and Applied Chemistry (1981) of the American Chemical Society (ACS), the Bruker Award (1990); the IES Gold Medal (1994); the Irving Langmuir Prize in Chemical Physics of the American Physical Society (1997); the Zavoisky Prize (1998); the E. Bright Wilson Award in Spectroscopy of the ACS (2008). A Festschrift Issue of the *Journal of Physical Chemistry* (July, 2004) was dedicated to him. Also, he has been a visiting professor at numerous other institutions including: Tokyo University; Weizmann Institute of Science; Aarhus University; University of Geneva; Delft University of Technology; L'École Normal Supèrieure, Paris; Hebrew University; University of Padua; Yamagata University; University of Oxford.

Michael Bowman, IES Vice-President Americas

Michael Bowman received a BS in Chemistry with Honors and a BA in Liberal Arts from the University of Kansas in 1971. He earned a PhD in Chemistry from Wayne State University under Larry Kevan in 1975 and was a postdoc with James Norris in the Photosynthesis Group at Argonne National Laboratory before joining the staff. In 1977 he spent five months with the group of Yuri Tsvetkov under the Inter-Academy Exchange Program. At the end of 1992 he moved to the Pacific Northwest National Laboratory and remained there until joining the faculty of The University of Alabama in 2007. His research interests include the development and use of pulsed EPR spectroscopy as a structural tool for understanding reactive systems in chemistry and biology. He serves on the advisory boards of two journals and one EPR center. He shared an R&D-100 Award with James Norris for the development of a Fourier Transform EPR Spectrometer and was awarded the IES Silver Medal for Chemistry in 2003.

Michael Davies, IES Vice-President Asia-Pacific

Michael Davies was awarded his B.Sc. and D.Phil. degrees from University of York, UK. He completed a post-doctoral position at Brunel University, before returning to the University of York as a staff member. In 1995 he moved to the Heart Research Institute, Sydney, Australia, where he is now Deputy Director and a Professor at the University of Sydney.

His research interests lie in mechanisms of protein modification by reactive species (radicals, two-electron oxidants, glycation reactions), the biological consequences of such reactions, and the development of methods to quantify protein damage in disease. He also has interests in EPR spectroscopy for the detection of transient radicals, extracellular matrix damage and the development of antioxidants.

He is a member of a number of editorial boards, is Secretary-General of the International Society for Free Radical Research, a Councillor of the American Society for Photobiology, an International Committee member of the Oxygen Club of California, and a past President of the Society for Free Radical Research (Australasia). Michael was awarded the IES Silver Medal for Biology/Medicine in 2003.

New IES Executives

Thomas Prisner, IES Vice-President Europe

Thomas Prisner received his Diploma in Physics from the University of Heidelberg in 1983, where he performed his Master Thesis at the Max-Planck Institute for Medical Research. He earned a PhD with Honors from the University Dortmund in 1989. After that he spent 2 years as a postdoctoral researcher at M.I.T in Cambridge, U.S.A. In 1996 he finished his Habilitation in Experimental Physics at the Free University of Berlin. Since 1996 he holds a full professor position in the Institute of Physical and Theoretical Chemistry of the Goethe-University in Frankfurt. His research concentrates on pulsed and high field EPR method developments and applications to biological macromolecules. He serves as editorial board member of the *Journal of Magnetic Resonance* and *Applied Magnetic Resonance* and is member of the EUROMAR and ICMRBS committees. He is a founder member of the Frankfurt Center of Biomolecular Magnetic Resonance and the Frankfurt Cluster of Excellence Macromolecular Complexes. He is vice-president of the German Magnetic Resonance Society and the German Representative in the European Federation of EPR Groups. In 1997 he received, together with Martin Rohrer and Klaus Möbius, the Phillip Morris Research Award and in 2008 the IES Silver Medal in Physics/Materials Science.

Sushil K. Misra, IES Secretary

Sushil Misra has been a Full Professor of Physics at Concordia University, Montreal (Quebec), Canada, since 1977, having received his PhD from Saint Louis University, USA in 1964. He spent sabbatical leaves at Harvard University, Paul Sabatier University (Toulouse, France), Technische Hogeshule (Delft, Holland), Monash University (Melbourne, Australia), and Cornell University. He has done extensive experimental and theoretical research in the area of electron paramagnetic resonance (EPR), also known as ESR and EMR since 1975.

He has over 230 published research papers to his credit, including 15 review articles and 7 chapters in books. Continuing his service to the EPR community, he is currently writing a book entitled "Multi-frequency electron paramagnetic resonance: Theory and applications" under contract with VCH-Wiley covering latest state-of–the-art techniques.

Under his research supervision 10 students have completed their PhD theses, 13 students have completed their MSc theses, and 6 students have completed their MSc reports. In addition, he supervised the research of 12 post-doctoral fellows. He served as an external examiner for the PhD theses of seven students at universities in Australia, Canada, France and India. Currently, he is a collaborating faculty member from Canada at the National Biomedical Center: Advanced Center for Electron Spin Research Technology (ACERT) at Cornell University. There, he has utilized the 170 and 250 GHz continuous wave EMR spectrometers, and has access to the 2D-ELDOR, DQC, and DEER spectrometers, as well as the facilities at the Cornell University Theory Center and CCMR Center, for his research. He was invited by the National High Magnetic Field Laboratory (NHMFL), Tallahassee, Florida as a collaborating visiting scientist to carry out measurements on their VHF (very high frequency, >140 GHz) spectrometers (June 13–27, 2006). He has extensively collaborated with international researchers. During 1982-83 (9 months), and in 1989 (3 months), he visited Paul Sabatier University under Coopération France-Québec. In 1985, he was invited as a foreign expert by the Ministry of Education, People's Republic of China, to present a series of lectures on EPR, and to appraise the teaching and research at the Materials Science Center at Nanjing University.

Tatyana Smirnova, IES Treasurer

Tatyana Smirnova received undergraduate Chemistry/Chemical Engineering Honors degree from the Lomonosov Institute of Fine Chemical Technology, Moscow, Russia in 1986. She was accepted to the graduate program at the University of Illinois at Urbana-Champaign in 1991 and earned a PhD in Chemistry under Prof. R. Linn Belford in 1997. She was awarded a NIH Postdoctoral Fellowship in 1997 and completed postdoctoral studies with Robert B. Clarkson at University of Illinois at Urbana-Champaign. Tatyana started as an Assistant Professor at North Carolina State University in 2000 and now is an Associate Professor there. Her research interests include the use and development of EPR spectroscopy, especially at high field/high frequency, as a tool to study fundamental roles of intermolecular interactions in biological self-assembly and structure-function relationship in multi component protein systems. In 2003 with support from the Visiting Scientist Program she worked at the National High Magnetic Field Laboratory and currently serves on the NHMFL Users Executive Committee.

The 6th General Meeting of the Asia-Pacific EPR/ESR Society

The 6th General Meeting of the Asia-Pacific EPR/ESR Society (APES) was held during the Asia-Pacific EPR/ESR Symposium (APES'08) in Cairns, Australia on July 16th, 2008 (see p. 33). 46 APES members attended the General Meeting.

The following researchers were elected as the APES Council Members for 2008-2010 as the Office Bearers during the meeting:

President: Prof. Sergei Dzuba (Russia)
Vice-President: Prof. Graeme R. Hanson (Australia)
Vice-President: Prof. Sa-Ouk Kang (Korea)
Immediate Past President: Prof. Hitoshi Ohta (Japan)
Secretary/Treasurer: Dr. Matvey Fedin (Russia)
Country Representatives:
Australia/New Zealand: Dr. Simon Drew
Japan: Prof. Seigo Yamauchi
Peoples Republic of China: to be appointed
India: Prof. P. Sambasiva Rao
Republic of Korea: Prof. Hong-In Lee
Vietnam: to be appointed
Russia (Far East): Prof. Elena G. Bagryanskaya
Founder President: Prof. Czeslaw Rudowicz (Poland; formerly Hong Kong)
Advisory Council Member: Subray Bhat (India)

The next General Meeting of APES will be held during the 7th APES conference in Jeju, Republic of Korea, in October 2010.

Sergei Dzuba,
APES President

Sergei Dzuba, APES President

Sergei Dzuba graduated from the Novosibirsk State University, Physics Department. In 1980 he obtained the Candidate of Sciences degree from the Institute of Chemical Kinetics and Combustion, Academy of Sciences of the USSR, Novosibirsk. In 1989 he obtained the Doctor of Sciences degree from the Academy of Sciences of the USSR. He became a Full Professor of the Novosibirsk State University in 1997. In 1995 he became the head of the Chemical Physics Faculty of this University. In 2003 he became the director of the Institute of Chemical Kinetics and Combustion. In the period from 1992 till 2003 he got guest professorships at the Kwansei Gakuin University, Japan, and Leiden State University, The Netherlands, each year for several months.

His current research interests include the development of new experimental approaches in pulsed EPR, study of general phenomena in molecular dynamics in disordered media, study of the structure and dynamics of biomembranes, study of photo-induced spin-polarized triplets and radical pairs.

He is a member of the Editorial Board of *Applied Magnetic Resonance*, President of the Asia-Pacific EPR Society, a member of the International Committee of Spin Chemistry.

Awards

Fellowship of the IES to Sandra and Gareth Eaton

From left to right: Chris Felix, Gareth Eaton and Sandra Eaton.

For details, see this newsletter, p. 35 and 18/1, pp. 2-3

Are you interested to become a member of the International EPR (ESR) Society? Please find the registration/information form for new/continuing members of the IES and non-credit-card payment instructions for individual members on this Web site: www.epr-newsletter.ethz.ch/contact.html

Simon Drew:

I was honored to receive a young investigator award for my multifrequency CW-EPR and DFT studies of molybdenum model complexes, which I carried out during my postdoctoral appointment with Prof. Hanson at the University of Queensland and it was nice to return to the warmer climate of Cairns for APES08 (snorkeling the reef at Green Island was great!). Although my collaborations with Prof Hanson continue, I am now establishing myself within a team of molecular and cell biologists, chemists and biochemists from The Department of Pathology, The Bio21 Molecular Science and Biotechnology Institute, the Mental Health Research Institute and the Centre for Neuroscience at the University of Melbourne, to study the pathogenic mechanism of various neurodegenerative diseases. The role of redox active transition metals is a strong theme within our group and I was fortunate to be awarded a 2008 Early Career Researcher grant from the University to carry out a range of isotopic labeling studies of Alzheimer's amyloid beta peptide, in order to delineate its various Cu^{2+} coordination modes using CW and pulsed EPR spectroscopy. This year has been a busy one and has seen my repertoire also expand into cell culture, recombinant DNA techniques and in vivo fluorescence imaging. Having also worked in magnetic resonance imaging, I found the sessions on the state of the art of biomedical EPR imaging on Thursday afternoon of immense interest. The many talks on spin labeling techniques and applications were also particularly valuable and I found myself frantically scribbling down ways I could apply what I'd heard to my own research problems. Thursday afternoon saw a special session on the formation of a national biomedical EPR centre in Australia and saw open discussions on how fund the infrastructure that Australia needs to remain internationally competitive. It was also nice to be present for the dedication to Prof. John Pilbrow, who was honoured for his contributions to the EPR community for over four decades. I thoroughly enjoyed APES08 and look forward to my new role as the Australian and NZ representative of APES.

Takanari Kashiwagi:

I was honored to receive the APES Young Scientist Award for my high field and multi-frequency ESR studies on quasi-one dimensional Heisenberg antiferromagnet NDMAP. This study has been conducted with many collaborators and I especially thank Professor M. Hagiwara at KYOKUGEN (Center for Quantum Science and Technology under Extreme Conditions) in Osaka University for his patient guidance and enlightening discussions. I am presently working as a technical assistant at KYOKUGEN in Osaka University and I have studied mainly physical properties of low dimensional antiferromagnet by using high-field and high-frequency ESR systems. We can perform ESR measurements at frequencies between 30 GHz and 2 THz in a magnetic field up to 55 T. I am currently engaged on studies of the physical properties in the field induced phase of quantum spin gap systems, such as Haldane magnet. We have developed an ultra-low ESR apparatus by using a dilution refrigerator, because the ESR measurements below 1 K are very important to understand the nature of quantum phase transitions and the ground state of spin gap systems. I also would like to investigate the nature of the geometrical frustration systems by using this ESR apparatus because unconventional ground states are sometimes expected to be observed at efficiently low temperatures. In addition, I am interested in biological systems and nanomaterials. This was my first attendance at the APES meeting that was very useful for me, because I had an opportunity to learn the present status of ESR/EPR studies and communities and to know the latest ESR techniques.

I really enjoyed the APES2008 meeting because there were many interesting topics, such as biological systems, development of ESR apparatus (high sensitivity, multi-frequency and high-field), biomedical applications, computer simulations and ESR imaging etc. I hope to make good use of this experience for my future research and to contribute to this exciting field.

Young Scientist's Awards of the APES to Simon Drew and Takanari Kashiwagi

Simon Drew (left) and Takanari Kashiwagi (right).

For details, see this newsletter, p. 33

2007 Lifetime Achievement Award to Ronald P. Mason

SOCIETY FOR FREE RADICAL BIOLOGY AND MEDICINE

Ronald P. Mason received his B.A. in Chemistry, Cum Laude, from the University of California at Riverside, his Ph.D. in Chemistry (physical), from the University of Wisconsin-Madison, and was a Postdoctoral Fellow at Cornell University, Ithaca, New York. In 1978, he joined the National Institute of Environmental Health Sciences, National Institutes of Health, Research Triangle Park, NC as a research chemist. At present, he is a Senior Investigator and Head of the Free Radical Metabolite Section in the Laboratory of Pharmacology and Chemistry.

Dr. Mason has devoted his career to the detection and study of free radicals derived from or dependent on the metabolism of toxic chemicals, drugs and biomolecules. Dr. Mason's original training was in electron spin resonance (ESR) spectroscopy, which is the only general, but yet selective, method for the detection of free radicals. Although this technique is predominantly used in the fields of chemistry and physics, Dr. Mason's ESR investigations of free radical metabolites have covered a broad range of topics in the biomedical sciences including the fields of biochemistry, pharmacology and toxicology. He has made several ground breaking discoveries related to the role of nitroreductase in drug toxicity and the free radical posttranslational modification of proteins. In addition, he has pioneered studies of in vivo spin trapping of free radical metabolites in whole animals. Using experimental rodent models, Dr. Mason's group has been very successful and productive in in vivo detection of the free radical mechanisms of diseases such as endotoxin-induced acute respiratory distress syndrome, alcohol-induced liver damage, and diabetes mellitus.

Recently, Dr. Mason has invented an immunoassay for detecting free radicals that brings the power of immunological techniques to bear on free radical biology. This approach has led to studies of protein radicals and DNA damage which have been validated by careful comparison with ESR results. In conjunction with mass spectrometry, this approach can determine the ex-act location of protein free radical formation. ELISA experiments have detected DNA radicals in cultured cells, and confocal fluorescence experiments have localized free radical formation to specific cell organelles. The immuno-free radical assay has been found to be advantageous over ESR due to orders-of-magnitude higher sensitivity than ESR, the need to use only one-thousandth of the sample size, and the ability to analyze multiple samples simultaneously. Lastly, expensive ESR instruments and, even more rare, the quantum mechanical expertise needed for ESR analyses are no longer required, which democratizes rigorous free radical detection.

Dr. Mason has managed to bring to his research a high level of creativity and excitement that has yielded a highly productive program. This program has prepared numerous members of his research group for careers in academic, government and industrial research.

Dr. Mason is a world-renowned and valued member of the world community of ESR spectroscopists, who recognized his work on free radical metabolism with his selection as the 1996 recipient of the prestigious International ESR Society Silver Medal. Dr. Mason is also the 1994 recipient of the Southern Chemist Award and Gold Medal given by the Southeast Region of the American Chemical Society. In 2006, he was recognized as Scientist of the Year by NIEHS. Mason has made major contributions to the field of free radical biology, medicine, and molecular toxicology. He is an accomplished professional, a dedicated scientist, and an effective mentor.

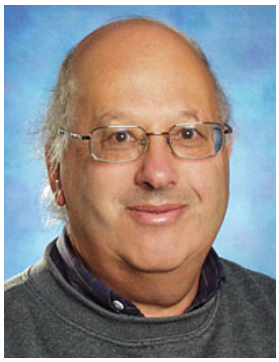
2008 IES Silver Medal for Instrumentation to Hitoshi Ohta

Hitoshi Ohta (left) and Wolfgang Lubitz (right).

For details, see this newsletter, p. 33 and 18/1, p. 4

Another Passion

OLYMPIC FEVER



John Boas

Olympic Fever... In 1984 I'd thought of combining a trip to Los Angeles for the 1984 Olympic Games with a side trip to Denver for the Rocky Mountains EPR Symposium. However, Gary Honey, whom I'd coached for 10 years from an under-developed 15 year-old to being ranked in the top six long jumpers in the world for the last three years, was a potential medallist and I'd been named as a coach for the Australian Olympic team. So Denver was out of the question – particularly since the day of the long jump final coincided with the start of the Denver meeting. Not for the first time, my passion for sport had won over my passion for science. Maybe it wasn't meant to be that way, but, as one of the original seven American astronauts said in a documentary about the space race, it was all due to "fate, luck – and the Russians".

My parents were born in Germany and came to Melbourne, Australia, in May 1938 for my father to take up a position as Senior Lecturer in the School of Metallurgy at Melbourne University. Their interests and circle of friends were intellectual and cultural, rather than sporting – the great Australian sports of cricket and (Australian Rules) football remained mysteries to them until the end of their lives. I was born in February 1941 and my parents were very keen for me to grow up as a good "Aussie", putting me through the State run school system and (mostly) not speaking German at home. My original interest in matters scientific was astronomy, as a result of the comet of 1947 and the brilliance of the night sky during the summer holidays at the beach. My interest in sport did not begin until I was nine, after we moved to the Melbourne suburb of Kew and I started 4th grade at Kew Primary School. On my first day I was asked "Whodjabarrackfor?" which translated from "Strine" meant did I support Collingwood or Hawthorn, the two local Australian Rules football teams. After some consideration I decided to follow Collingwood (the Magpies), the working class team who were near the top of the table, rather than Hawthorn (the Hawks) who at that time were hopeless. The main reason for this choice was that most of the tough kids in the class (and the school) followed Collingwood and it was safer for me, as the class "brain", to hang out with them and have some sort of protection when it came to the frequent schoolyard fights.

Although I learned to play cricket and football- sort of- my real interest in sport began during the 1952 Olympic Games when Emil Zatopek and the Australian women sprinters Marjorie Jackson and Shirley Strickland made the headlines. Then in December 1952, John Landy[1] ran the fastest mile in the world for seven years and the race for the 4 minute mile was on. After I'd beaten some of my classmates in a race around a nearby park, over about a mile and then over about 3 miles, I was challenged to run a race around the block – close to a mile – against anyone in the school who wanted. I won again, but this remained the extent of my sporting achievements for nearly 3 years.

For the last 4 years of school, from 1955 to 1958, I went to University High, a State run, academically selective, co-educational Senior High School. My athletic ambitions returned with the 1955 school cross-country race (compulsory, but for boys only), which was run as an age-based handicap over about 6 km. I ran the whole way, being somewhere in the first 10 until the last km or so when the older boys caught up. I finished about 60th out of 400+ and was the first of my class of 45 or so to finish. This and the approach of the Olympic Games to be held in Melbourne in November 1956 encouraged me to start regular training. I followed the schedules outlined in the recently published "Franz Stampfl on Running", which had appeared in the school library and which I'd also persuaded my parents to give me for Christmas, along with Roger Bannister's "The First Four Minutes". Although John Landy was my hero, Bannister struck an immediate chord when he described his own feelings at a similar age when he discovered that running gave him a sense of freedom and mastery over himself. Although I was only 15, I ran in the under 17 880 yards at the 1956 University High Sports (there were no races longer than 220 yards for younger age groups) and finished a close 3rd to the two 16 year olds who had finished 1st and 2nd in the School Cross Country. Apparently it was the most exciting race of the afternoon and for the first time I gained recognition from my peers and the teachers as something more than just a brain (swot, nerd, geek etc.). Despite University High's reputation as an academic powerhouse and a place where brainpower was at least tolerated, one's status depended on one's performance on the sports field.

The 10,000 metres on the first day of Athletics at the Melbourne Olympic Games still remains the greatest distance race I've ever seen and ignited my passion for track and field at the Olympic Games. The favorites were Vladimir Kuts (USSR) – the 10,000 m world record holder and Gordon Pirie (Great Britain) – the 5000 m world record holder. Kuts led from the start and set a ferocious pace, with Pirie following a stride behind. No-one else dared to follow and before long the rest of the field were far behind. Kuts began surging – on the back straight of every lap he'd sprint down the back straight, open up a 10 metre gap, only to find Pirie on his heels again at the end of the lap. This went on for lap after lap until, with 1500 metres left (just under 4 laps), Kuts took off with a sprint for nearly half a lap. Pirie could respond no longer – and the race was over. Kuts went through the finishing line with his arms raised and ran a lap of honour to a standing ovation from all of the 100,000 in the stadium. I read long afterwards that Kuts was so far gone himself that if that final surge hadn't broken Pirie he would have pulled out. The following day I didn't have ticket for the Games, but went for a run at 5 in the afternoon. I don't remember how far or for how long I ran, but before I'd gone far I'd started sprinting between every alternate street light pole, imagining I was racing Kuts

[1] John Landy was Governor of Victoria, a symbolic role as representative of the Queen, from 2001-2006.

and Pirie in the 10,000 metres at the 1960 Olympic Games.

When it came to the School Sports in September 1957, I'd been unable to train properly for about 4 weeks because of an infected toe, but I still managed to win the under 17 years 440 yards[2] in 55.7 seconds (on a rough 330 yards grass track), taking 4½ seconds off the school record. The photo shows that I won by a big margin and ran through the line with my arms in the air- a la Kuts. Some people loved it, but there were quite a few disapproving mutterings – this was 1957 and such gestures of emotion "just not done". My thoughts as I approached the line were along the lines of "here's one for the swots against the jocks".

Some 10 days later, 5th October 1957, I joined Ivanhoe Harriers – the Athletics Club in the next suburb. I never thought that I'd still be a member 51 years later. That same day Sputnik was launched (the first earth satellite) and the world changed. The panic in the "Western World" was amazing... "The Russians have got ahead of us... They'll be able to drop nuclear bombs on us... Our scientists are no good... Our mathematics and science education is out of date... etc..."

[2] 402.3 meters.

The response at University High was immediate. Six weeks later I was included in a newly created accelerated program restricted to the top 30 of those intending to do maths and science in the final year of school. To be in the class of the best and the brightest in The Selective State High School and to be a sports star on the athletics track was "Brain and sports jock heaven", to misquote from Tom Wolfe's "The Right Stuff". So by the end of 1957, my twin passions of sport and science, were well and truly alight and I've never lost them.

After a somewhat underwhelming time as an undergraduate at Melbourne University, in March 1963 I went to Monash University, established in 1961 on the outskirts of Melbourne. I had no clear idea of what I wanted to do, other than some sort of research. I was very quickly attracted into EPR (the Russians again!) and a project of Gordon Troup's to build a super-sensitive EPR spectrometer with a sapphire maser as a pre-amplifier for looking at free radicals in cancerous tissues. After a year of building spectrometer electronics, Gordon suggested that while waiting for the workshop to build the maser cryostat, I look at the metalloproteins ferritin (the mammalian iron storage protein) and hemocyanin (the copper containg oxygen carrier of some molluscs and arthropods). It was my luck and Gordon's insight that I shared a lab. with Peter Elliston, whose project was on the EPR of small superparamagnetic oxide particles. These were about 10 nm in diameter – similar to the ferric oxyhydroxide core of ferritin. Discussions with Peter about our mutual problems led me to approach another of our colleagues, Brian Window, to use ferritin to test his Mössbauer effect cryostat. Our results showed that the iron oxide core of ferritin was superparamagnetic and we wrote a short paper for submission to *Australian Journal of Physics*. Gordon and Professor Robert Street (Brian's supervisor and the foundation Professor of Physics at Monash) encouraged us to submit it under our names only. It was unprecedented for two junior postgraduate students to submit a paper without their supervisors as co-authors. This led to scepticism from the referees and publication was delayed until the Prof. wrote some strongly worded letters. The hemocyanin story also had a happy ending, leading to the copper dimer story and over 40 years of collaboration with John Pilbrow, who had arrived at Monash in March 1965.

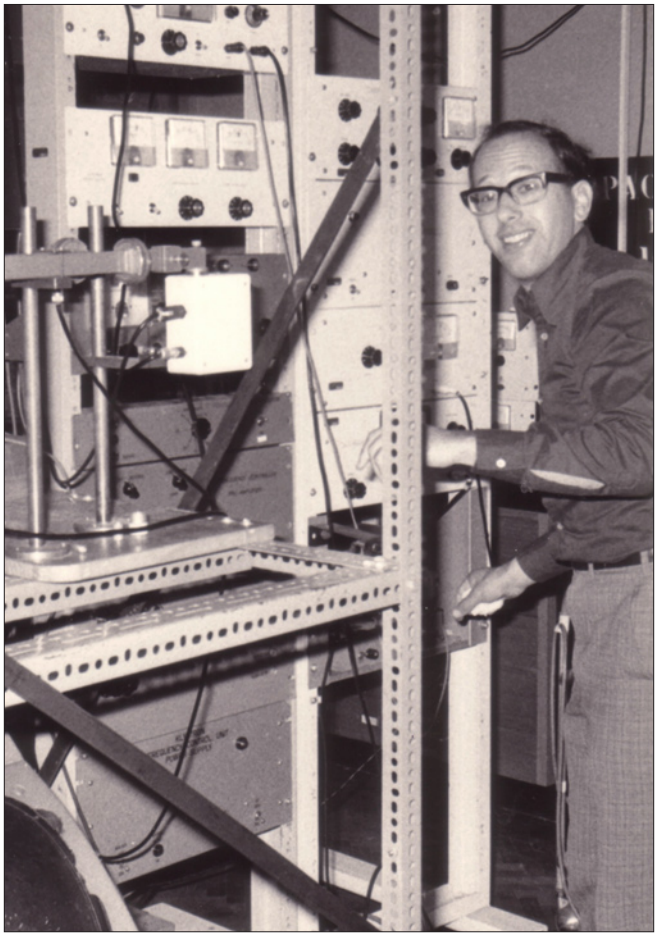
I finished my PhD in late 1968. After a series of post-doctoral appointments (Keele and Essex Universities in the UK and at Monash with John Pilbrow) and a year of teacher training, I spent nearly 2 years teaching maths and science at one of the most difficult schools in Melbourne. I was rescued in November 1978 by the Australian Radiation Laboratory, the Australian government radiation protection laboratory, to start a research group in solid state dosimetry. This enabled me to use the planning and management skills I had learned through sports administration and coaching. I remained at ARL until May 2000, eventually becoming Principal Research Scientist in charge of the Australian measurement standards for ionising radiation absorbed dose and exposure. Since my retirement, I've been an Honorary Research Fellow in Physics at Monash University, following my passion for EPR.

My sporting passions also evolved, from being purely an athlete to being involved in club administration and then in 1962 becoming the first qualified coach in the Ivanhoe Harriers. From 1964 onwards I also became involved with the establishment of the Monash University Athletics Club. Many of us trained together at lunchtime and were already involved in the administration of our local clubs. The links formed during those lunchtime training sessions were a key part of

the network that gradually removed the old guard administrators of the sport first at club, then at state and finally at national level. Development of skills in strategic thinking, program planning and administration and people management were not part of any school or university course in the 1960's, but we all learned these as on the job training through our sporting activities. In my case, the skills one hopes to develop as a scientist of an inquiring mind, logical thinking and analysis of observations were critical to my development as a coach. My athletes still make jokes about "the nutty professor" or "the mad scientist", my coaching colleagues say I have an analytical mind, but I tell my athletes to leave the scientific analysis to me because "too much analysis gives paralysis".

My success as a coach underpinned much of what I was able to do in helping to drag the sport into the latter part of the 20th century. I'd done some coaching when I was in England and restarted my coaching with my old club when I returned to Australia in November 1972. In mid 1973, the younger brother of one of my 400/800 runners started pestering me to coach him for triple jump. This was Ian Campbell who at 16 was already something very special. Despite my protestations that I knew nothing about triple jump, I eventually agreed to do what every scientist does when confronted with a new problem- read the literature. I came across reports of the multiple jump (bounding) training done by the USSR track and field superstars of the 1972 Olympics; the 100 and 200 meter gold medallist Valery Borzov (later sports minister of the Ukraine) and Viktor Saneyev, the triple jump gold medallist in 1968 and 1972 (and again in 1976). No one else in Australia did this type of training and I introduced bounding into Ian's program. Other coaches thought I was crazy and would ruin him. However, 18 months later he became my first international athlete and the youngest male athlete to represent Australia. Ian's success attracted others and I eventually developed a reputation as a long and triple jump specialist. Gary Honey joined the group in late 1974 as a 15 year old wannabe triple jumper from another unfashionable outer suburb of Melbourne. He appeared to be too small, too slight and too slow to ever amount to much, but had a burning desire and passion to succeed, and by 1978 was recognized as a future star. I was accredited as "Senior Coach" in 1978 and Gary's switch from triple jump to long jump was one of the factors in my becoming National Coach for Long Jump in 1980.

I'd followed my Olympic passion by going to the Games in Mexico, Munich and Montreal, the latter as a reconnaissance knowing that I was likely to have athletes in the team in 1980. I therefore travelled to Moscow as a personal coach with athletes in the team. In Moscow, Ian's best jump – a probable medal winner jump – was ruled a foul in controversial circumstances for a breach of an outdated (and now non-existent) rule. Ian was devastated by what had happened and due to this and injury retired from competition shortly afterwards to rise very high in Nike in the promotion and marketing area. Gary Honey had also made the team but his run-up fell apart in the qualifying round and he missed the final. We both learned much from the experience and on returning to Australia began a four-year plan to win a medal at the 1984 Olympics in Los Angeles.



In the next 4 years, Gary set out to become the best prepared athlete he could possibly be. He never missed a session and he developed from being regarded as suspect under pressure to being feared around the world as one who was never beaten if he had one jump left. As the coach, I could only follow his dedication, commitment and passion for the Olympic dream. In the end, success or failure came down to the six or seven seconds it takes to do a long jump, on August 6th, 1984, the day of the Final, Men's Long Jump, Los Angeles Olympic Games.

Carl Lewis (USA) – possibly the greatest athlete – and certainly the greatest long jumper – of the 20th century, had the event won as expected with his first jump of 8.54 m. The real battle was for the other medals. Gary moved into second at the start of the 3rd round with a personal best and Australian record jump of 8.18 meters. I held my breath for the USA's Larry Myricks's 5th jump – he had been ranked 1st or 2nd in the world since 1979. 8.16 meters and I breathed again – just. First jump of the final round – and Giovanni Evangelisti (Italy) jumped 8.24 to take over 2nd and I thought it was all over. Gary was next. He charged down the runway, hit the takeoff perfectly and flew. 8.24 m and he was 2nd again, on the countback. I could hardly bear to watch the last few jumps, but there wasn't enough room to hide under the seat. Myricks had the very last jump of the competition. The crowd was roaring as he ran down, but he choked and took off so far behind the board that he gave up before completing the jump. Gary Honey, the little kid from Thomastown, had won the silver medal.

For Gary, it was the fulfilment of a childhood dream. Although he remains my most high profile success as a coach, I've gained similar satisfaction as a coach from helping other athletes achieve their place in the sun, not only in the sporting field but also as members of the wider community. For me, the 1984 Olympic Games in Los Angeles was also the fulfilment of a childhood dream – not quite in the way I'd imagined it would turn out, but then that's due to fate, luck – and the Russians.

70th Birthday of John Rayner Pilbrow. 70 years young – 48 years in EPR

John was born on the 28th of March 1938 and spent his early years in country New Zealand before his family moved to Christchurch in 1948. He attended Christchurch Boys' High School* (1951 to 1955), where he was also Captain of Athletics, a member of the Debating Team and for three years, one of the 'Lab Boys' who had the responsibility for setting up equipment for classes and, at other times, the 'run of the lab'. From 1956-1960 John attended the University of Canterbury, located in Christchurch where in addition to his studies he was Secretary of the Athletics Club and represented the university on the track in the mile and in cross country running. He was introduced to EPR when undertaking his M.Sc. research, his project involving the construction of an EPR spectrometer and experiments on Cr^{3+} in GASH in both parallel and perpendicular modes.

Although New Zealand Universities had begun to grant PhD degrees, as John had long decided he wanted to go overseas, he obtained a Scholarship which enabled him to go to the Clarendon Laboratory in Oxford to do his D. Phil. in 1961. At that time, the Clarendon, under Brebis Bleaney, was still very much the centre of the EPR Universe. Michael Baker's lab was next door where the first ENDOR in Britain had just been carried out and John Owen and James Griffiths still had an active group across the corridor. There were many notable visitors to the Clarendon during John's time and Brebis Bleaney used to bring them to the Hayes Lab for coffee. These included Alexandr Prokhorov, Norman Ramsey and John van Vleck.

John's D.Phil supervisor was Bill Hayes, who set him the task of exploring the effect of X- and UV-irradiation of alkali halide crystals containing transition metal ions, monitoring valence changes and kinetics using mostly EPR and some optical spectroscopy. John made an immediate impact by introducing a copy of the 465 kHz klystron frequency controller he had built during his M.Sc. in NZ. By locking the klystron frequency to the sample cavity this enabled spectrometers to be operated at all hours, independent of temperature fluctuations and, more importantly, independently of the voltage fluctuations in the Oxford City electricity supply. This increased the throughput of spectrometers by a factor of three and saved many all-night sessions and much frustration.

After completing his D. Phil in 1964, John accepted an appointment as Lecturer in the Department of Physics at Monash University, a recently established university (first students in 1961) on the then outskirts of Melbourne, Australia. Despite being told by Bleaney that he "would be unlikely to get much research done there", the Monash appointment held attractions for John in that it was a lot closer to Christchurch than the US where he had been offered a postdoctoral position. From Gordon Troup, whom he had met in 1963, John learned that there were already operational X and Q band spectrometers (constructed by Gordon's first graduate students, J. R. W. (Jim) Thyer and the late D. R. (Don) Hutton respectively), a plentiful supply of liquid helium and most attractive, a new 15 inch Varian magnet. John arrived at Monash in March 1965 with the thought of moving away from EPR into Superconductivity, but these deviant thoughts lasted less than a day. Gordon was on sabbatical in Italy, but R.H. (Roger) Dunhill, one of Gordon's four current graduate students, approached John at 5pm on his first day at Monash about the disappearance of resonances from frozen aqueous solutions of copper (II) citrate in the pH range 7-11. John's suggestion that Roger increase the concentration resulted in the observation of a very broad resonance, interpreted by John as arising from dipolar coupling between two Cu^{2+} ions. After much laborious algebraic manipulation, John was able to formulate perturbation theory expressions for the resonance fields and transition probabilities of this coupled system. Using these, John developed a computer program which enabled the simulation of the lineshape and the determination of the distance between the copper ions. The distance of 3.1 Å was confirmed by "ball and stick" molecular models put together by Tom (T.D.) Smith, who had recently arrived at Monash to take up an appointment in the Chemistry Department. This was the start of the Pilbrow-Smith collaboration that lasted until Tom's retirement in 1996. The studies of transition metal dimers and related systems became a major activity of the Monash EPR Lab. from 1967 onwards. The productivity of John and Tom and their graduate students from both Physics and Chemistry was a major factor in the obtaining of a large ARGC grant in 1973 for the purchase of a Varian E12 EPR spectrometer. This instrument replaced the home-built Thyer/Troup spectrometer as the workhorse and was operational for over 30 years. Its significantly improved sensitivity, magnetic field linearity and stability demanded a much more critical approach to the computer simulations. These led to the consideration of low symmetry effects and the distribution of spin Hamiltonian parameters. Together with the theme of interactions between paramagnetic ions, the themes of low symmetry and the distribution of spin Hamiltonian parameters have been a major part of John's research in EPR.

In addition to his involvement in the copper citrate problem and undergraduate teaching in 1965, John was persuaded to give a series of graduate level lectures on spin Hamiltonians and the solution of EPR problems by perturbation theory. This was the first of several graduate level courses given by John over the years and eventually led to his book, "Transition Ion Electron Paramagnetic Resonance" which was published in 1990.

* The famous Lord Rutherford was a teacher at the school in 1895 before heading to Cambridge and scientific fame!

In another article, John will refer to a very fruitful interaction in 1966 with Martin Spaeth who came from Stuttgart. This was the first of a number of collaborations with scientists from outside the Monash campus. Another came in 1967 when John was approached by Malcolm Winfield from the CSIRO, who had obtained a spectrum of Co (II) in a reduction product of cobalamin (Vitamin B_{12}) using a Varian V4500 spectrometer in the CSIRO Division of Applied Chemistry. Although at first sight the interpretation of this spectrum appeared almost trivial, John's careful simulations showed that the problem was anything but trivial and required monoclinic symmetry and the non-coincidence of g and A matrix axes. A sequel to this work was some later studies of Co(II) complexes where John noted a dependence of the linewidth on the nuclear quantum number- the precursor of g-A strain distribution models of the linewidth.

John, with his family, took two sabbaticals in the USA. In 1971, as a Fulbright Senior Scholar, his time was split between the late Max T. Rogers at Michigan State and Linn Belford at the University of Illinois. With Linn Belford he worked on the electronic structure of Cu^{2+} in monoclinic sites and on the representation of hyperfine matrices. In 1979, John spent the year with Jim Hyde and Hal Swartz at the Medical College of Wisconsin where multifrequency EPR including S-band highlighted the dependence of hyperfine linewidths on nuclear quantum number and microwave frequency. He designed an S-band cavity that operated at 2, 2.9 and 4 GHz which allowed experiments to be carried out at all three frequencies during a given experiment. An identical cavity was later built at Monash University. It occurred to John around 1984 that it should be possible to design a compact microwave bridge at S-band using micro-strip and strip-line technology. Funding to employ a microwave engineer was provided by Monash University which led to a successful electronically controlled prototype operating at 2.5 GHz.

In 1981, John managed to answer the challenge posed by Jim Hyde a couple of years earlier regarding the relationship between field-sweep and frequency-sweep. He first of all predicted that looping transitions, found for example in ruby [Cr^{3+}:Al_2O_3] will become increasingly asymmetric as the coalescence point is approached. His colleague, Don Hutton, had kept examples from his PhD research in the early '60's and these were repeated and simulated successfully.

John's lectureship became permanent after three years and he was quickly promoted to Senior Lecture and then Reader. He was Head of Department from 1991 to 1999 and was appointed to a Personal Chair in Physics. As Head of Department, John faced many challenges. Firstly he had to oversee the merger of his own department with the Physics Department at the neighbouring Caulfield Institute of Technology that had been joined to Monash during 1990. This was no easy task, owing to the cultural differences between the two institutions. John's next major challenge came in the mid-1990's when changing funding models and budgetary constraints imposed the need for restructuring and reductions in staff numbers. John then had the very difficult task of persuading a number of his friends and colleagues to take early retirement. John's third major challenge was the result of his realisation that the future research directions of Monash Physics needed to move away from their traditional emphasis on condensed matter physics, magnetism, EPR and Mossbauer spectroscopy towards X-ray and Synchrotron Physics and Nanotechnology. Although financial constraints did not allow the necessary appointments to be made during John's time as HOD, recent senior appointments in the Department [now School of Physics] reflect the change in emphasis.

In the midst of all this turmoil, John was able to pursue his research in EPR with the assistance of a series of very able post-doctoral fellows and postgraduate students in both Physics and Chemistry. He was able to put together a community of interest in EPR covering not only Monash but also Melbourne and LaTrobe Universities. This resulted, in 1993, in the acquisition of the Bruker ESP380E FT/CW spectrometer located at Monash in the School of Physics and of Bruker ECS106 spectrometers for the Chemistry Departments of the other two universities. The advent of the pulsed EPR led to studies of glasses doped with transition metal ions in sites of no local symmetry, development of new pulse sequences and the use of ESEEM to identify copper binding sites in peptides.

In 1998 John was a member of an ad hoc Monash Precinct Synchrotron Taskforce that sought and obtained agreement between Monash University and the CSIRO that the Australian Synchrotron should be located at or near Monash University. John would claim that he played only a minor role in these negotiations. Australia's first synchrotron became a reality in 2001 when the Victorian State Government announced that it would fund its construction on the Monash site. The Australian Synchrotron, at Monash, was completed ahead of time and under budget and has been operational for more than a year.

In the wider world, John took on major roles in the Australian Institute of Physics (AIP), the International EPR Society (IES) and the Asia-Pacific EPR society. For the AIP, John has served as Honorary Secretary [1975-1976], Vice-President [1997-1978] and President [1990-2000]. As President John steered the Institute into the centre of Science Policy debate in Australia and was heavily involved in the annual 'Scientists Meet the Parliament' in Canberra. For the IES John served as Secretary [Sept 1997 – Sept 1999] and then President [Oct 1999 – Sept 2002]. In recognition of his contributions to the field of EPR and to the IES, John was elected as a Fellow of the IES in 2006. His contributions to EPR were recognised earlier by the award of the Bruker Prize and Bruker Lecturer at the Royal Society of Chemistry ESR Group meeting in 1998 in Manchester (UK) and by his becoming an Honorary Member of the National Magnetic Resonance Society of India in 2000. John's role in the organisation of conferences is covered in the accompanying article History of EPR in Australia.

John decided to step down as HOD at end of 1999. He had had in the back of his mind to switch to part-time for three years before retiring at 65, to pursue other interests, but the option to retire at 62 actually opened up more time for these other interests. Appointed Emeritus Professor of Physics at the beginning of 2001, John continued with research for three days a week for several years, and taught himself to do pulsed EPR on the Bruker instrument given that he had time to do so.

In recent years, the focus of his research has been in cluster compounds in collaboration with the author and Professors Alan Bond and Keith Murray from the Monash School of Chemistry. The first steps in interpreting a spectrum were often scribbles on the back of a table napkin in the Faculty Club! This year, having reached 70, John decided that it was time to let go after 48 years in EPR. No more experiments! However, this decision has meant a change in field, rather than a reduction in activity. John has long had an interest, going back almost 50 years, in the interface between Science and Religion, in

Standing: Timothy, Michael, Simon, Jonathan, Daniel, Elizabeth, Jane, Bridget. Sitting: Susan and John. Not present: Peter.

particular, the impact of modern scientific paradigms on Christian thought. He is currently President of the Institute for the Study of Christianity in an Age of Science and Technology [ISCAST]. In 2007 he lectured at the Faraday Institute in Cambridge, UK.

John and Susan were married in 1961, just before leaving for Oxford. They have nine children and 17 grandchildren. They enjoy walking, riding mountain bikes, reading, listening to music, thoughtful movies, travel and spending time with their extended family. As well as their direct extended family, they have a further extended family of scientific colleagues and friends, both in Australia and around the world. This article necessarily concentrates on some of John's professional and personal achievements. Many more words would be needed to adequately cover John's influence on all our lives as guide, philosopher, counsellor, teacher, colleague, mentor, advocate, muse and above all, friend. Long may it continue.

John Boas
(with assistance from Graeme Hanson, Chris Noble and Simon Drew and clarification of key points from JRP)

John R. Pilbrow: An Interview to the EPR newsletter

EPR newsletter: *Dear Professor Pilbrow, on behalf of the readers of the EPR newsletter we congratulate you on your 70th birthday. We are most appreciative that you agreed to answer the questions of this interview. Why did you start towards your career in science and why was it EPR?*

My interest in science went way back to my early schooldays at a small country primary school in New Zealand. My mother had a cousin who was Director of a nearby NZ Government Laboratory, The DSIR Grasslands Division. He had a Doctorate in Science in Botany. During WWII his laboratory was seconded to work on methods to produce dried fruit and vegetables for the troops in the Middle East and later in the Pacific. I remember at the age of 6 or 7 having to help fill out response sheets as to the quality and usefulness of things such as dried bananas, potatoes and apples. So I suppose that represented my first involvement in a scientific experiment. The second thing I remember is that our school had a rain gauge – a large bottle with a funnel on top. I was about 8 years old and I remember explaining to the Principal that because the funnel diameter was larger than the inside diameter of the bottle, the measurement would be inaccurate. I'm afraid no notice was taken of this. Then at the age of nine, I went on two school excuirsions that remain significant for me. The first was to the Glaxo Dried Milk Factory about 8 km from where I lived. I remember being impressed by laboratories with coloured chemicals and people in white coats. The second visit was to Massey College [now Massey University], then just an Agricultural College. Again I saw labs with people in white coats as well as animal houses and cropping experiments. I don't think I was particularly drawn to chemistry or agriculture but important scientific seeds were sown in my mind.

Our family moved to the City of Christchurch in 1948 and I was exposed to a much bigger school. From there I attended a large Boys' High School from 1951-1955 where my exposure to science and mathematics was extensive. Our school had a system of Lab Boys in each of the Biology, Chemistry, Physics and General Laboratories. For three years I was a Lab Boy in the Physics Lab where one had the responsibility of setting up equipment for Physics classes. Otherwise one had the run of the labs between times. The Head of Chemistry was a 'self-appointed' Careers Teacher and during my first two years at the school, he interviewed every student to ask what they wanted to do when they

left school. The first year I said 'Research Chemist' and his reply was that I'd need a PhD. I was 12 or 13 years old. The following year, I told him I'd decided to be a Physicist, to which he replied, 'Well, you'll still need your PhD. Where do you propose to do your PhD?" My answer was instant, "Oxford, Sir'. He said, "Well, see that you do!"

So it was natural on entering the University of Canterbury in 1956 to specialize in Physics and Mathematics. I spent a very happy summer vacation 1957-1958 as a Vacation Student at the NZ DSIR Physics and Engineering Laboratory, in the Geothermal Division, designing and building a flow meter for use about 200 m under the ground in the geothermal region of NZ to measure flows of about 1 cm^3/h at temperatures of ~600 °C. My first ever publication, in 1959, in the Journal of Scientific Instruments in the UK, was the result of that work. The following summer I built a 'Noise Meter' as a noise standard for the Upper Atmosphere Group in the Physics Dept., but decided I was not really drawn to that area of research. Having completed my Honours degree in Physics at the end of 1959, I looked forward to beginning research the following year as I had decided to do a Masters degree in the hope of securing a scholarship to Oxford for 1961. Dr. Alan Runciman who'd come from Harwell and was later at MIT and the Australian National University, was in charge of the MSc projects. He interviewed me and offered me two options – either optical spectroscopy or EPR spectroscopy relating to transition metal ions in crystals. I had about 30 seconds to decide. I picked EPR and ended up building a spectrometer and carrying out both '⊥' and '//' field experiments on Cr^{3+} in GASH! I did obtain a scholarship in 1961 that enabled me to move to Oxford in September of 1961. After investigating superconductivity and deciding against it, I joined the group of Dr Bill Hayes, and undertook EPR and some optical spectroscopy of transition metal ions in alkali halide crystals and studied monovalent states that resulted from X- and UV-irradiation of the crystals.

• *Why being a NewZealander and completing a PhD in Oxford [Oxford calls it a DPhil] did you end up in Australia?*

As I approached the third and final year of my DPhil research, I started looking for a job. I was married with small children and needed to make a sound decision. I had on offer an excellent postdoctoral position in the USA which eventually I turned down. I discussed the possibility of returning to the University of Canterbury but my old Professor explained that there were no jobs going at the time and that I should 'stay away' for at least another three years to broaden my experience. I noticed an advertisement for positions at the new Monash University in Melbourne, Australia, founded in 1961. What had impressed me was that there was a flow of excellent publications from Monash Physics in magnetism and solid state physics, including some EPR. So I applied and took up an appointment as Lecturer in Physics in March 1965. This became permanent three years later and over the next 6-7 years I had two major promotions, I had many excellent PhD students and I was in an environment where research was strongly encouraged.

I haven't quite answered the question as to why being a NZ-er I ended up in Australia. My father had been battling cancer for many years and in the end our decision was based on being near enough to our family in NZ and Melbourne was a reasonable compromise. The three years 'further experience' became 36 years until I decided to retire three years early to begin to pursue other interests as described in a previous EPR Newsletter.

• *What were the benefits of a PhD [DPhil] in Oxford?*

Coming as I did from NZ it was essential at that time to have overseas experience whether for PhD or at the postdoctoral level. Oxford was a great experience, though initially something of a shock. Now instead of being in a group of six beginning graduate students, I was one of some 40 in the Clarendon Lab which was only part of the Oxford Physics scene. I have previously talked about the 041 Coffee Club which took place in our Lab, that had previously been Brebis Bleaney's lab before he became the Professor and Laboratory Head. Brebis took a sabbatical during my middle year, but I had the privilege of seeing him most days for a total of about two years and in fact he was my acting supervisor [Thesis Advisor] during my final year when Bill Hayes was in the USA. It was a broadening experience. Most weeks I attended 3-4 seminars on a variety of topics, something I have written about previously.

• *What are the dangers of commercial EPR spectrometers?*

While I have been the satisfied recipient of two commercial spectrometers since 1974, I think the experience of building even a basic spectrometer, and being forced to think about what is going on, has no substitute. 'Turnkey' instruments can also provide creative opportunities but my advice to young researchers in EPR is to find something they can design even if it is not the whole instrument.

• *Where do you see EPR going?*

Apart from Europe and Japan, where there remain many Physicists, the bulk of EPR is in Chemistry, Biology and, increasingly, Biomedical applications. I see this trend continuing.

• *Are there any young EPR researchers whose work you follow?*

Having been retired formally for almost eight years, I no longer attempt to keep up with the literature. I certainly follow the careers of my last two PhD students, Drs. Chris Noble [Univ. of Queensland] and Simon Drew [Univ. of Melbourne].

• *What do you think about the young generation of the EPR researches and what is your message to them?*

During my career, often during Grant Interviews panel members said something like 'But isn't EPR a field looking for a problem?". There can be some truth in that, but I have to say I always found making sense of EPR observations to be a significant intellectual challenge, as demanding as the problems I saw others in other fields pursuing.

To young people today, my advice is attempt to be multi-skilled. If you are a specialist in EPR, seek experience using complemetary techniques.

• *In what way do you think your research ever influenced anybody in the EPR community?*

That is for them to say. Since Jim Hyde posed the problem of the relationship between field and frequency sweep to me back in 1979, I think the fact that I did manage eventually to understand what was involved gave me considerable satisfaction. It helped me and my group to change the philosophy of EPR field sweep simulations in a more intuitive way. Those insights don't matter for free radicals but involve fewer lineshape parameters than is the case in conventional simulation approaches where the distinction matters. The work we did on copper, vanadyl and titanium dimers in the 1960's and early 1970's was picked up by several groups though today distance measurements are more likely to involve pulsed methods rather than CW.

• *What would you have done if given a different opportunity?*

I might have persisted with an interest in superconductivity but as my career in applications of EPR to a variety of problems has been both challenging and rewarding, I really have nothing to complain about.

30th Anniversary of the Denver EPR Symposium

The EPR Symposium and the Evolution of Modern EPR

Sandra S. Eaton and Gareth R. Eaton

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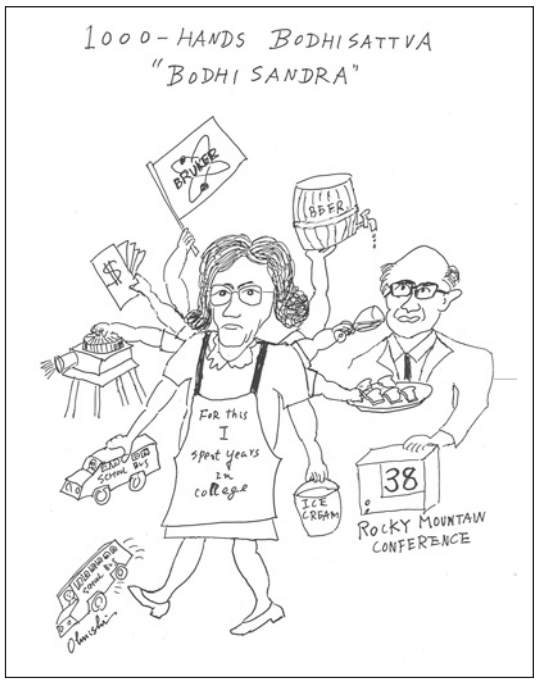


Genesis

Many people ask, when and why did we begin the EPR Symposium, and why did we continue? The Rocky Mountain Conference on Analytical Chemistry and Spectroscopy (sometimes titled with subsets of these words) is in its 50th year. At the time we became involved, it was a well-established conference with primary emphasis on analytical chemistry. In fact, many of the people who did the work to make the conference happen each year were students of Professor Rod Skogerboe at Colorado State University. He asked us to become involved and enhance the spectroscopic aspects at the same time that Dan Netzel, Laramie Energy Technology Center and Gary Maciel and his coworkers at Colorado State University were starting to bring NMR, initially of macromolecules and eventually solid state NMR, to the Conference. For most of the history of the Rocky Mountain Conference, it was run with volunteer labor, printing was done as corporate (or government lab) donations, etc. It was not until 1998, when we ran out of former students of Skogerboe, which, together with a decrease in Federal and corporate support of science communication in Colorado, caused us to decide that we needed a professional to do the work that professors did not want to do. Fortunately, for the past decade, Mark Stone (Milestone Presentations) has provided professional assistance to keep the Conference going.

The Conference originally was sponsored by the Society for Applied Spectroscopy and a group called the Chromatography Discussion Group. Neither organization is active in Colorado any more. The Conference was formally a committee of the Colorado Section of the Society for Applied Spectroscopy. Recently, we found ourselves in an awkward situation in which we were legally part of an organization that was not maintaining it tax exempt status, was not submitting income tax returns, etc. The American Chemical Society did not want any legally-binding association with the Rocky Mountain Conference, because they already had a regional meeting, and they want total control of any meeting run by ACS. Note that the Conference is "endorsed by" not "sponsored by" the American Chemical Society and the Society for Applied Spectroscopy. In the past couple of years Kurt Zilm in NMR as Chair of the Conference, and Sandy as Treasurer, have spent substantial time getting by-laws written, getting the finances in order and audited, submitting tax returns, getting the Conference established as an independent tax exempt organization, etc. All of this goes on below the radar of people who come for the science, but it has to be done and it takes an enormous amount of work.

It is interesting to note that although costs change, some issues remain current:

– The overall focus of the Rocky Mountain Conference in 1978 was energy and the environment.
– The banquet speaker talked about solar energy.
– You could have a hotel room in downtown Denver for $20 to $30/night.
– JEOL and Varian were the magnetic resonance exhibitors.

Ed Janzen was the first speaker in the EPR Symposium and John Waugh was the first speaker in the NMR Symposium (Fig. 1). The 9 EPR papers the first year reflected the activity in EPR at the time – spin trapping, spin labels in biology, spin probes, transition metals, and solid state materials. We described spin-spin interactions.

Our first Open House, in 1978, was a "Demonstration of the University of Denver Computer-interfaced EPR Facility."

In the second year, 1979, 63 papers were presented. The growth to 63 papers on a wide range of topics, and the wise advice from Jim Hyde, that the Symposium was needed, kept us, and hence the Symposium, going. The first session of the second Symposium was chaired by John Wertz, whose fundamental studies and textbook taught so many of us.

Sponsors

No conference can succeed without sponsors. The sponsors benefit from learning what the users are interested in being able to do. Should they build a spectrometer so that everyone else can do this new cutting edge experiment? Bruker has been the major sponsor of the Symposium since the second year, for which the international EPR community is immensely grateful.

- 1979 Varian
- 1980–1983 Varian, IBM/Bruker
- 1984–1992 Bruker and Medical Advances
- 1993–2001 Bruker
- 2002 – recent years:

– Bruker
– Jules Stein Professorship Endowment
– Medinox, Inc.
– Molecular Specialties
– National High Magnetic Field Lab
– Scientific Software Services

Other contributors

Many others contribute – some contributed many times, others only once. No donation is too small. This is especially true for support of student registration and travel. We need to nurture the next generation of scientists who use EPR, regardless of the level or the application.

- Centers for Disease Control
- Department of Energy
- Digilab
- JEOL
- LakeShore Cryotronics
- MicroNow Instrument Co.
- New Era Enterprises
- Norell
- OMRF Spin Trap Source
- Research Specialties
- Resonance Instruments
- US EPR, Inc.
- Varian Microwave Power Tube Products
- Wilmad Glass

Bruker new product introductions

Bruker supports EPR by developing new technologies. Many of them were introduced to the community at the EPR Symposium. When we were in Denver where it was feasible, they even introduced the W-band instrument, with supercon magnet operational on the floor of the exhibit hall. Some of the new Bruker product introductions at the "Denver meeting" were:

- 1987 ESP380 X-band pulse
- 1996 E680 W-band pulse
- 2001 Xepr on Linux; ER 4123D dielectric resonator for spin labels
- 2002 superQFT Q-band pulse
- 2003 Transient system
- 2004 L-band imaging system
- 2005 EMXplus
- 2006 EMXmicro and EMXplus; 6T EPR supercon magnet; SpecJet II; L-Band pulse bridge
- 2007 New superconducting magnet and Hall; S-band pulse; Molecular Sophe

Workshops

There is an interesting story about the first Workshop, which was on the future of EPR. Gareth was riding in a taxi in New York City with NIH program officer Caroline Halloway, who was known to many people in EPR. She commented that people in science should put more effort into thinking about the future of their field of research. He said that many of us were having informal discussions about the future of EPR. She asked, "why not a formal discussion with a report?" He replied the only way one would to an NIH official "money." She immediately asked for a budget, approved it, and before the taxi ride was over the 1987 Workshop on the Future of EPR was planned. Five years later we had to submit a formal grant proposal for the second Workshop on the future of EPR.

Several years later, Bruker offered to jointly sponsor with the University of Denver a series of topical Workshops to help people exploit the capabilities of modern EPR spectrometers. These can continue, on whatever topics you think we should discuss. The handouts for many of these workshops can be downloaded from the Bruker Biospin web site.

- 1987 Workshop on the Future of EPR
- 1992 Workshop on the Future of EPR
- 1999 First Pulsed EPR Workshop
- 2000 Workshop on Pulsed EPR
- 2001 Multifrequency EPR Workshop
- 2002 Workshop on EPR of Aqueous Samples
- 2003 Workshop on Measuring Electron-Electron Distances by EPR
- 2004 Workshop on EPR Imaging
- 2005 Workshop on Selecting an EPR Resonator
- 2006 Workshop on Computation of EPR Parameters and Spectra
- 2008 Workshop on Quantitative EPR

Presentation of scientific results

Do you remember cracked glass-covered slides? Do you remember speakers who used two slide projectors and an overhead projector for a short talk? Do you remember early users of PowerPoint who invoked the sounds of breaking glass? It took a while for people to realize that many of the special features of PowerPoint get in the way of communication.

How to structure a talk or a poster is not a trivial or obvious matter. There are a lot of technical details about color, font sizes, etc. to think about, in addition to the overall presentation style. To try to help people learn from what we have observed over the years, we have a set of notes posted on our web page. We have updated this over the years to evolve with the technology.

The one thing that has remained constant is the need for a timer!

Which medium is the most effective way to communicate science?

Maybe one of the most controversial matters is oral vs. poster. There are still people who feel that poster presentation is second class relative to oral presentation. They miss the central question: "which medium is the most effective way to communicate the science?" Some things are much better presented in a poster. A poster has the advantage that it can be studied at the viewer's schedule and pace, there is the opportunity for one-on-one discussion in depth, and

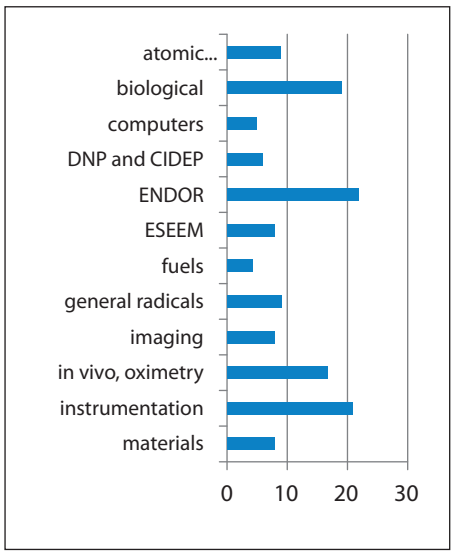
20th Annual Rocky Mountain Conference
on Analytical Chemistry

Denver Convention Complex
Denver, Colorado
August 7-9, 1978

EPR Symposium
G. R. Eaton, Chairman
Tuesday, August 8, 1978

9:00	Introduction - Dr. Gareth R. Eaton
9:05	Detection of Free Radicals in Aqueous Solutions by Spin Trapping, E. G. Janzen, University of Guelph.
10:00	ESR Studies of Stable Spin Probes in Liquid Crystals, G. V. Bruno and M. P. Eastman, University of Texas at El Paso.
10:50	Thermal and Spin Label Studies of Scorpion Cuticle, T. R. White and W. S. Glaunsinger, Arizona State University.
11:30	The Internal Viscosity of Spinach Thylakoids, A Spin Label Study, S. P. Berg, D. M. Luxczakoski, and P. D. Morse, II, University of Denver and Wayne State University.
2:00	Metal-Nitroxyl Interactions, P. M. Boymel, G. A. Braden, J. R. Chang, D. L. DuBois, K. More, R. E. Smith, D. J. Greenslade, G. R. Eaton, and S. S. Eaton, University of Denver, University of Exxex and University of Colorado at Denver.
2:40	Analysis of EPR Spectra of Spin-Labeled Copper Complexes, D. L. DuBois, G. R. Eaton, and S. S. Eaton, University of Denver and University of Colorado at Denver.
3:10	EPR Studies of $[FeNO]^7$ Complexes, R. D. Feltham, H. Crain, and T. Malone, University of Arizona.
3:35	EPR Linewidths in Linear Chain Systems, B. Garrett, Florida State University and S. Holt, University of Wyoming.
4:15	Charge Compensation in the Impurity Centers of Doped Ionic Crystals. Determination by EPR Spectroscopy, G. L. McPherson, Tulane University.
Evening -	Demonstration of the University of Denver computer-interfaced EPR facility.

Figure 1. Program for the first EPR Symposium.



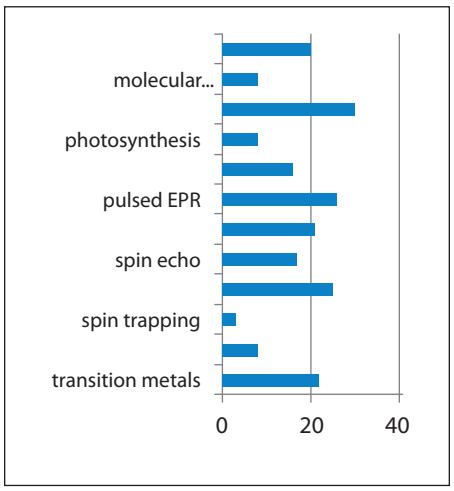


Figure 2. The scope of the symposium.

individual points can be emphasized. Some "big picture" ideas and/or tutorial material are better presented orally, where it is easier to use the persuasive voice. Rarely is it more valuable to present a highly mathematical topic orally than in poster. The most difficult problem this Symposium faces is the residual feeling that verbal presentations are more important than posters. We have tried to lead by having almost all of our presentations as posters, and by never having anything scheduled in conflict with posters, and by having posters up for the full time of the Symposium.

Poster presentation has changed from 8½ by 11 inch sheets separately pinned to the poster boards to large, single-sheet color prints from PowerPoint. Along the way, some innovations with overlays, etc., sometimes got more attention than the content of the poster, to the dismay of the presenter.

When the so-called "electronic paper" can be part of the poster, you will see another revolution in presenting scientific information.

International EPR Society

Often, meetings are run by topical societies. The EPR Symposium had been going for a dozen years before people realized that the attendees really did constitute a community that would be well-served by a professional society. The International EPR Society was formed at the 12th EPR Symposium in 1989. Hal Swartz provided the leadership necessary to get the Society started and to work out the international organization.

EPR Newsletter

The NIH-funded EPR Centers started a Newsletter in 1987. When the Society started 2 years later, this newsletter became the EPR Society Newsletter, with the same editor, Lynn Belford at the University of Illinois. Many years and issues later, it has become a very professional newsletter under the excellent guidance of Laila Mosina in Kazan. We urge you to contribute to it.

Applied Magnetic Resonance

EPR has so many applications that many "EPR papers" are published in the topic journals of the areas to which EPR is applied. *Journal of Magnetic Resonance* and *Magnetic Resonance in Chemistry* were supplemented by Kev Salikhov's creation of *Applied Magnetic Resonance*. It is now available electronically, which will broaden access to papers published there.

Scientific Meetings are Important

The meeting in Novosibirsk in 1989 helped build bridges between scientists who could previously communicate mostly through scientific journals. The Meeting in Hong Kong in 1997 stimulated communication among scientists in southeast Asia, who are members of the Asia Pacific EPR Society.

EPR at Work

Via Workshops like the one held the Sunday before the EPR Symposium, application

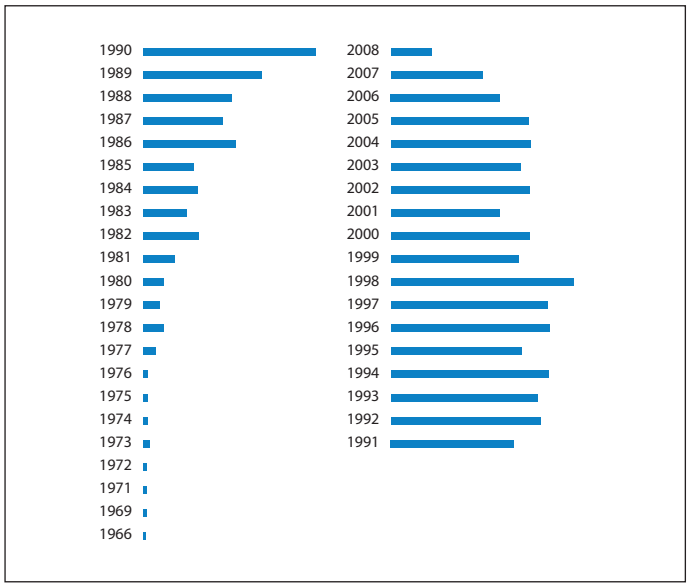


Figure 3. The development of EPR spin trapping, 1966-2008, based on citation in SciFinder.

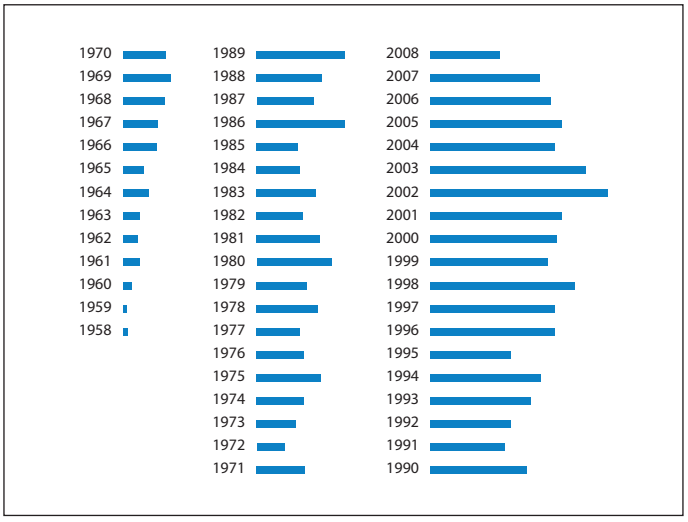


Figure 4. The development of Quantitative EPR, 1959-2008, based on citations in SciFinder.

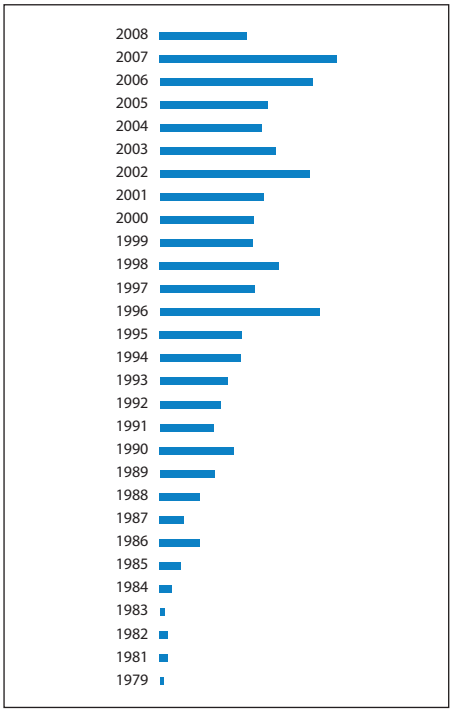


Figure 5. The development of EPR Imaging, 1979-2008, based on citations in SciFinder.

notes, and formal courses, instrument vendors help people learn how to use and where to apply the tools available. One famous set of advertisements was the Varian "EPR at Work" series. Many of these were written by Jim Hyde. They were similar to a "letter to the editor" of major journals. Together, they constitute an impressive overview of applications of EPR. We brought these up to date and compiled them in 2005 in a volume of Concepts in Magnetic Resonance, which is available as a separate issue for only $30.

EPR Books

A sampling of the books about EPR that have been published since 1978 illustrate developments in the field. Presentations at the EPR Symposium, starting in 1979, stimulated a lot of interest in pulsed EPR. This was the same year that the Time Domain Electron Spin Resonance book by Larry Kevan and Bob Schwartz was published. Multifrequency EPR from MHz to THz provide different views of electron spins and important insights. Multiple books have been written about organic radicals and especially nitroxyl radicals, which have been the foundation on which much of modern EPR is based. Both the intellectual content and the flavor of the early development of EPR were collected at the time of the celebration of 50 years of EPR at the EPR Symposium in 1994, and published in 1998 in Foundations of Modern EPR, published by World Scientific. Many books focusing on applications of EPR have stimulated the field.

In vivo and imaging

Spins are actually homogeneously distributed in very few samples. EPR imaging makes it possible to study the actual distribution. Applications range from materials to humans, and micro to macro scale. In vivo imaging requires attention to the effect of dielectric properties of samples on the EPR spectrum. Commonly, the EPR spectrum is being used to report on some other property, such as oxygen concentration via in vivo oximetry. The rapid developments in this field are reported at the annual EPR Symposium.

The focus of the "Denver Meeting" over the years has been on instrumentation and methodology, independent of application (Fig. 2). Breadth of exposure to new areas can stimulate science, but some people vote with their feet and leave the room if the discussion strays from the area of their own research.

Some topics are chosen because of EPR Society Awardees, some because people want to honor one or another person, and some by volunteers who have a topic they want to develop. Many topical sessions chosen do not happen because the volunteer does not get the job done.

Each year we invited people to suggest topics for future years, and we accepted most (almost all) volunteers to organize half-day sessions at the Symposium. However, we usually did not announce very early that these topics will be emphasized the next year because only roughly 40% of volunteers actually ever followed up by organizing a session. There is now a formal, self-perpetuating, group to organize the EPR Symposium.

Overall, the topics follow the federal research money.

Since the first lecture in the series of annual International EPR Symposia was on spin trapping, we use this as the first example of the growth of the field over time. It is interesting to see how it takes a while for applications to grow. It took over 20 years to reach something like steady state (Fig. 3).

The growth of Quantitative EPR probably reflects the improvement of EPR in-

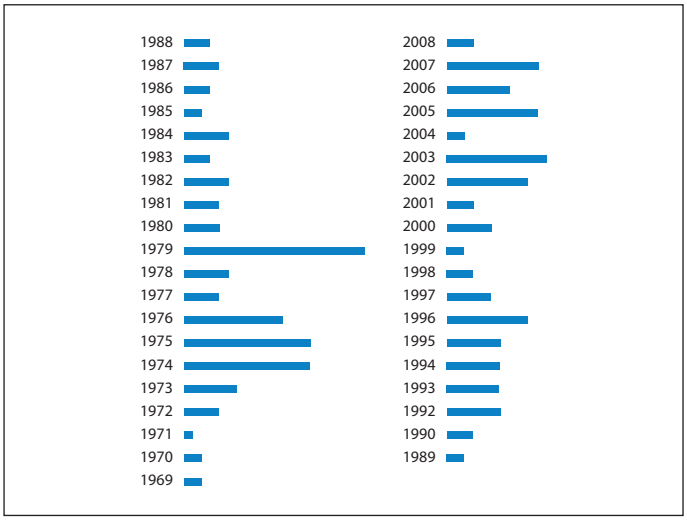


Figure 6. The development of EPR – ELDOR, 1969 -2008, based on citations in SciFinder.

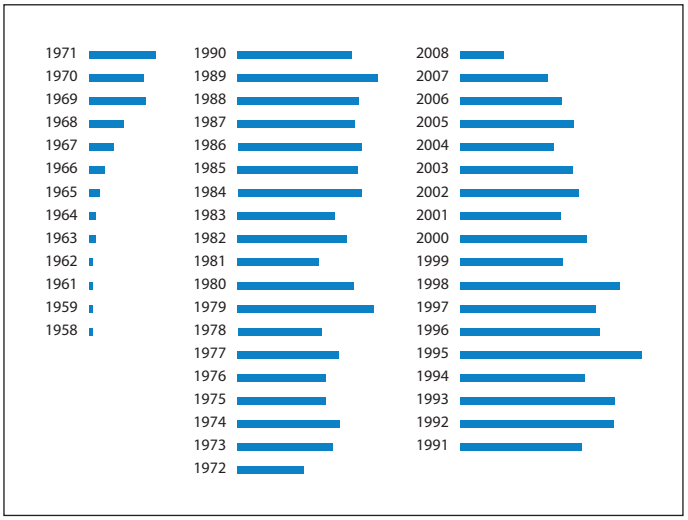


Figure 7. The development of EPR – ENDOR, 1958-2008.

Figure 8. Celebration of Jim Hyde's 70th birthday, 2002. We will let Jim explain why Helmut Beinert is giving him a rabbit for his 70th birthday.

strumentation, and the understanding of the importance of resonator Q to the quantitative measurements (Fig. 4).

Imaging is still on a growth curve. This is a technology-driven curve so it does not have the usual shape (Fig. 5).

The annual publication of ELDOR papers is small (DEER and PELDOR are separate). The largest number in any one year was 20, and that was due to the publication of the Dorio and Freed book in 1979 (Fig. 6). We predict that this area will exhibit increased growth now that an ELDOR spectrometer is available from Bruker.

After a fairly typical 15 year growth curve, ENDOR has remained a steady, strong part of EPR with over a hundred papers per year (Fig. 7).

Doing Something New

The EPR Symposium has focused on exposing people to new advances in instrumentation and methodology, regardless of the specific application. We strive to identify and stimulate new ideas at an early stage and bring them to the attention of the EPR community via the Symposium. Mice, molecules, materials – it does not matter which, if there is something everyone should learn about how to investigate spins.

A major goal has been cross-fertilization of ideas between different areas that use EPR. It has been a disappointment that some people choose to attend only talks or posters that are closely associated with the topics they are currently researching or methods that they are currently using. For example, the audience changes dramatically when the topic changes between spin trapping and transition metals.

We also are disappointed when someone comes just to present their lecture and does not interact with people during the rest of the Symposium.

Topics of recent reviews of EPR

What is the current scope of EPR? At least as viewed by chemists, the topics of current interest are those that have been presented at the EPR Symposium.

Over the past three decades, EPR has become multi-dimensional, multi-frequency, non-linear, time domain, multi-pulse, multi-quantum, heterogeneous samples, gradient fields, etc., exploring spins wherever they are.

One index of the scope of modern EPR is the topics reviewed recently in the Royal Society of Chemistry Specialist Periodical Reports on EPR:

- Biological free radicals
- Biomedical aspects of free radicals
- Dating
- Dosimetry
- EPR and ENDOR of metalloproteins
- Exchange-coupled oligomers
- FTEPR
- Free radicals in biomolecular injury and disease
- High field EPR
- Imaging
- Measurements of interspin distances
- Organic radical ions
- Paramagnetic centers on solid surfaces
- Photosynthetic reaction center
- Pulsed and time-resolved EPR of transient radicals
- Pulsed ENDOR
- Radiation damage to DNA
- Radical intermediates in flavoenzymes
- Spin labeling, spin probes, and spin trapping

This year, the EPR Symposium program included a lot about spin-spin interactions, including a workshop on DEER, biomechanisms, which includes a lot of transition metal EPR, materials, EPR imaging, force microscopy, high field EPR, and spins for memory devices, computations, and development of new instrumentation, among other topics.

The EPR Perspective

There are over a hundred definable EPR experiments, and more are created every year. The next time someone asked you "how long will it take to get an EPR spectrum," consider how narrowly you have to answer that question. There are so many ways to look at the electrons.

Computers and EPR

When we proposed interfacing a computer with an EPR spectrometer in 1972, most people thought we were crazy. We and Larry Piette followed Chuck Klopfenstein. Independently, Ira Goldberg was doing it on a contract that we did not know about until later. By the time of the 1992 Workshop on the Future of EPR, Bruker was telling the community that computer software was becoming the "hard" and costly part of the EPR spectrometer. In 2006 the Workshop showed that the future will involve heavy use of computer simulation as part of the interpretation of EPR spectra. Now, spectroscopists have available Xepr and other programs for acquiring spectra, and Xsophe, Molecular Sophe, Gaussian, ORCA, etc. for calculating spectra from first principles.

Celebrations of Awards and Anniversaries

The EPR Symposium has hosted celebrations of awards and anniversaries (Fig. 8). When Clyde Hutchison was honored in 1991, the members of the clan that gathered included Art Heiss and Ralph Weber, on whom we depend to bring us new products from Bruker and train us in their use.

"There are spins everywhere"

In this brief survey of the past 30 years we have mentioned only a few aspects of EPR. The idiosyncratic selection might reveal some blind spots. We point to the wide range of oral and poster presentations at the Symposium this year as partial extension of this talk. We hope to learn next year what spins you have seen since the 31st Symposium.

Wayne L. Hubbell:
An Interview to the EPR newsletter

EPR newsletter: *Dear Professor Hubbell, on behalf of the readers of the EPR newsletter we congratulate you on your 65th birthday. We are most appreciative that you agreed to answer the questions of this interview. Why did you start towards your career in science and why was it EPR?*

When I was 10 years old, I had a serious accident that confined me to bed for an extended period. To give me something to do, my parents bought me a microscope; an old Leitz. It was very high quality, and I made a lot of discoveries with that microscope. From that time on, I planned to spend my life in science. In my undergraduate years at Oregon State University I studied Zoology. An insightful Professor of that subject convinced me that the future of biology was in chemistry, and I had better learn some. I took his advice, and ended up as Chemistry major. I did undergraduate research with Kenneth Hedberg on the gas phase structure of small molecules using electron diffraction. This stimulated interest in gas phase microwave spectroscopy, and for graduate work I went to Stanford University because Hedberg told me that there were exciting things going on in that area. Upon arriving, I found out that Harden McConnell was starting to apply EPR methods to problems of biological interest. That fit so nicely with my latent biological interests that I convinced McConnell to take me on as a graduate student. It was not gas phase microwave spectroscopy, but at least it involved microwaves.

• *Where do you see EPR going?*

You should know that I have a necessarily narrow view of EPR, i.e., I really only know about biological applications of EPR, and then really only about the spin labeling niche. I have very little knowledge of metal ion EPR and the many applications of EPR in physics, and these are more important to many people that anything I do. So I could not pretend to provide insight into the future direction of EPR in general. However, a question that I could answer is "What are your future directions in EPR?". In response to that question, I can say that my research will continue to be focused on understanding how proteins, membrane proteins in particular, perform their functions. It is now clear that many function through internal motions that occur on time scales well-suited for investigation with spin labeling EPR, and EPR has important advantages over NMR in exploring dynamics in complex systems. So we will continue to develop the technology in that direction through the design of new spin labels in collaboration with Kálmán Hideg (University of Pećs), through the application of high pressure and saturation recovery EPR, partly in collaboration with Jim Hyde (Medical College of Wisconsin), Mark Newton (University of Warwick) and Wojciech Froncisz (Jagellonian University), and through the application of multifrequency and 2D ELDOR in collaboration with Jack Freed (Cornell University). Another exciting direction has recently emerged. In collaboration with Peter Schultz (The Scripps Research Institute) and Kálmán Hideg we have demonstrated that a nitroxide side chain can be introduced into proteins in high yield via non-native amino acid incorporation during protein synthesis. This opens up new possibilities for selectively spin labeling a protein in a complex mixture and incorporating spin labels into proteins without the necessity of removing endogenous cysteine residues as is done in conventional site-directed spin labeling.

• *What do you think about the young generation of the EPR researches and what is your message to them?*

This is a difficult question for me. The young scientists that I interact with are clearly focused on solving biological problems. Some of them, a number from my laboratory, have chosen to use EPR spin labeling as a key tool in their research, but virtually none of them set out to do research in EPR itself. In my own case, I love EPR because it provides me with a view of molecular events that could not be obtained by other methods. Very often, new strategies in EPR must be developed to move forward, and I greatly enjoy this process where development of technology is driven by the problems to be solved. When you have a new tool with which to explore, new and unanticipated discoveries often come quickly. Doing scientific research is a very personal activity for me and I hesitate to give advice, because motivations vary widely among people. One feeling that I do try to pass on to my students is that a career in science should be an entertainment; it must be fun. If that is the case, research will be all-consuming; it will be a search for answers rather than some kind of competition, and discoveries will quite naturally be made in essentially any area of endeavor.

• *In what way do you think your research ever influenced anybody in the EPR community?*

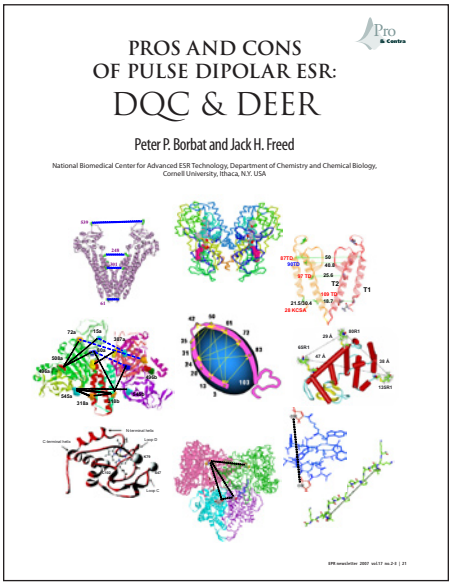
I leave that judgement up to the EPR community.

• *What would you have done if given a different opportunity?*

Given the time frame in which I began research, if I were to start again, I would

follow exactly the same path. I have always been motivated to understand the molecular basis of function for proteins and biological membranes, and EPR spin labeling was clearly a means to provide answers. Given this motivation, it is fair to ask a different question: if I were starting at the beginning today, would I again choose EPR as a main tool? That is a complex question, since in the meantime NMR, single molecule optical spectroscopy, atomic force microscopy and time-resolved X-ray diffraction tools have come on the scene in major ways. Still, for me EPR would be the choice because of the nature of the problems I choose to study.

Jack H. Freed:
An Interview to the EPR newsletter



EPR newsletter: *Dear Professor Freed, on behalf of the readers of the EPR newsletter we congratulate you on your 70th birthday. We are most appreciative that you agreed to answer the questions of this interview. Why did you start towards your career in science and why was it EPR?*

I was always interested in science. As a youngster, I had a substantial chemistry set-up in my basement at home. Growing up in New York City, I could regularly go to Fisher Scientific Company's central store to purchase chemicals. I even had mastered college chemistry texts before taking chemistry in high school.

My interest in the field of ESR began as a graduate student at Columbia University. I was intrigued by the possibilities of using ESR to study molecular dynamics in liquids. I was also fascinated with the application of statistical mechanics to the analysis of ESR spectra. I have particularly enjoyed the interplay between developing newer and better experimental ESR methodologies and newer and better methods of their theoretical analysis.

• *Where do you see EPR going?*

It is my belief that we are now in a watershed period for the ESR field, something like the period of one or two decades ago in NMR, when the latter emerged to its present prominence. The ESR field is currently in a similar period. The potential of ESR is exemplified by its high spin sensitivity, its excellent spectral resolution, its heightened sensitivity to the motion of molecules, its ability to measure both short and long distances within and between molecules, its ability to image a probe molecule with micron resolution, the limited degree to which the measurement disrupts the host, and the convenience of the measurement. Other methods may excel according to one or more of these criteria, but in many ways, ESR provides an optimal combination of all of these features. Despite these significant advantages, ESR had been lagging far behind techniques such as NMR in its applications to chemistry, physics, biology, and medicine. The reasons for this were mainly the technical challenges of higher frequencies and faster timescales. Recently, the technological gap between NMR and ESR has dramatically narrowed and many new methods in ESR have been implemented. This resurgence of interest in ESR is leading to emerging new ESR centers world-wide.

• *What do you think about the young generation of the EPR researches and what is your message to them?*

I believe this is an exciting time to be starting a career in ESR. There are so many wonderful applications in all fields of science in addition to opportunities for further innovations in experimental and theoretical methodologies. However, there is still the challenge to educate the scientific community to better appreciate the role of ESR and to have it occupy its proper place amongst the currently more popular methodologies.

• *In what way do you think your research ever influenced anybody in the EPR community?*

In my work, extending over 45 years at Cornell University, I take special pride in the development of a firm theoretical foundation, based on the stochastic Liouville equation, for the interpretation of a wide range of ESR experiments and the development of new ESR technologies, such as two-dimensional Fourier Transform ESR, double-quantum-coherence ESR, and taking ESR to much higher frequencies. I leave it for others to assess the impact of this work.

• *What would you have done if given a different opportunity?*

It is hard, after so many years working at Cornell in ESR, to consider what else I might have done. Perhaps the greatest challenge to carrying out research in the U.S., and certainly at Cornell, has been the need to raise 100% of the funding to support the research. This has been my least desirable activity. I would have welcomed an opportunity that would have relieved me of that burden.

History of EPR* in Australia

John Pilbrow
School of Physics, Monash University

In this article I have combined my own recollections with a good deal of information provided by many of my Australian colleagues. I make no claim that it is an exhaustive history and I apologise in advance to any whose work has been overlooked. Nevertheless, I have tried to convey something of the variety of research involving EPR/ESR over more than 50 years 'down under'.

The Australian story really begins in New Zealand when former NZ Rhodes Scholar, G. S. (Gib) Bogle, took up a lectureship in Physics at the University of Otago in 1952, straight from the Clarendon Lab. His first student, Volker Heine [1], constructed a basic EPR spectrometer, where the klystron power supply was a bank of lead-acid car batteries, and conducted experiments on gadolinium sulfate octohydrate. Bogle moved to Sydney in 1955 to work for the CSIRO [2].

CSIRO

Beginning in 1955, Bogle and an English physicist, Harold Symmons, at the Division of Radiophysics in Sydney, built a spectrometer incorporating a klystron frequency stabiliser [3] operating at 465 kHz, and investigated the EPR of transition metal and rare earth ions in crystals, searching for solid state laser materials. Bogle obtained a position at the Bell Telephone Laboratories to begin early in 1962, but, on New Year's Eve 1961, he died under tragic circumstances, an unsolved mystery that from time to time is the subject of TV documentaries. EPR continued until Symmons and another physicist, D. W. Posener, retired around 1975.

Dr. Malcolm (M. E.) Winfield, a Chemist and Frank Looney, a Physicist, working in the Division of Applied Chemistry [4] in Melbourne obtained a Varian V4500 spectrometer. Winfield investigated low spin cobalt in cobamides and cobinamides and he also collaborated with Dr. R. L. (Ray) Blakley, a Biochemist at the Australian National University (ANU) [5], on properties of B_{12}.

Dr. Cyril Curtain, while working as a Biochemist, at the Baker Medical Institute in Melbourne, saw the potential for EPR in medicine as far back as 1960 but could not raise funds for a spectrometer either then or later when Head of the Molecular Biology Section, CSIRO Division of Animal Health, where he studied lipids and the stimulation of white blood cells. During a sabbatical in California in 1972 he attended a seminar on spin labelling in Harden McConnell's lab at Stanford and immediately recognised that spin labelling was the way for him to go. From 1975, when he became Section Head for Biotechnology at the CSIRO Division of Chemical Technology, he collaborated with Frank Looney on membrane fluidity and dynamics using EPR. (See later reference to Curtain under Melbourne University.)

At the Division of Chemical Physics [6] in Melbourne, an EPR Group under Dr. I. D. (Doug) Campbell obtained a Varian V4500 in 1963 for investigations on zinc oxide.

The first EPR spin labelling experiments in Australia were actually carried out in the Division of Food Technology in the early 1970's by the late John Raisin, who studied, particularly, lipid transition temperatures. Cyril Curtain later collaborated with Raisin on mitochondrial lipids.

EPR at Monash University

EPR has been carried out in the Department (now School) of Physics since 1961, much of it involving collaboration with several colleagues in the Chemistry Department. As some of this story is told elsewhere in this issue by John Boas I have tried to keep any overlap to a minimum.

The story begins with Dr. Gordon Troup, who while working and studying in the UK, published a short monograph in 1958 entitled Masers, later revised as Masers and Lasers. Gordon had returned from the UK and spent about three years at the Weapons Research Establishment in South Australia, before joining the Physics Department at the brand-new Monash University in 1961. He immediately established research in EPR, AFMR (with pulsed magnetic fields up to 150 kG) and Cyclotron Resonance. Gordon's first PhD student, J. R. W. (Jim) Thyer, built an X-band spectrometer, incorporating a Bogle-Symmons 465 kHz klystron frequency stabiliser, which remained the workhorse instrument until the arrival of the Varian E12 in 1974. Thyer's PhD was concerned with defects in BeO, of interest to ANSTO (Australian Nuclear Science and Technology Organisation) as a possible moderator in nuclear reactors. Gordon's second student (1962-1964) was D. R. (Don) Hutton, from NZ, who had been one year behind me both at High School and University in NZ. Troup and Hutton employed EPR to investigate natural minerals using the characteristic signatures provided by low concentrations of transition metal or rare earth ions, like Bogle and Symmons, looking for solid state maser materials. Hutton's PhD yielded six papers, one of which appeared in Nature.

I joined the academic staff in Physics at Monash in 1965. Gordon Troup was in Italy on sabbatical, though I had met him when he visited Oxford in 1963 after attending the Quantum Electronics Conference in Paris. The meeting with Gordon's student, Roger Dunhill, at the end of my first day at Monash, that cemented my on-going involvement in EPR, is described elsewhere by John Boas. This led to a long and fruitful collaboration with Chemsistry colleague, T. D. (Tom) Smith, on a variety of copper, vanadyl and titanimum dimers. My contribution was to work out the theory and to develop computer simulation programs to enable the distances between the metal ion centres to be determined for similar ion dimers and, later, for a variety of dissimilar ion dimers. While we did not observe a half-field or 'forbidden $\Delta M = 2$' spectrum for the first of our dimers, copper citrate, the observation and simulation of such transitions proved crucial for many of the later dimers we identified. My collaboration with Tom Smith continued on a range of other problems in inorganic chemistry, with particular emphasis on porphyrins

* Both EPR and ESR will be used as appropriate.

Photograph of Martin Spaeth and John Pilbrow, Department of Physics, Monash University 1966. Photographer, R. L. Bryant. Courtesy of Monash University Archives.

and porphyrazines, culminating in some neat experiments on their binding to DNA.

In 1966, Dr. Martin Spaeth, who had just completed his doctorate at Stuttgart on the ENDOR of H atoms in KCl, spent ten months in the Physics Department. Martin, a Deutschesgemeinshaft Postdoctoral Fellow, had come to Melbourne as his Australian wife was studying at Melbourne University. We collaborated on the EPR of Cu^{2+} in NH_4Cl as a function of temperature, and wrote two papers before Martin returned to Germany, a fact that astounded Professor Pick in Stuttgart who thought there would be little opportunity for research in Australia! Martin was appointed Foundation Professor of Physics at Paderborn in 1974 where he established very fine facilities in ENDOR and ODMR. He won the IES Silver Medal for Physics/Instrumentation in 1996.

Early in 1967, John Boas and I had a visit from Dr. Malcolm Winfield, mentioned above, concerning EPR of reduced B_{12} as part of the collaboration referred to earlier with R. L. Blakley at the Australian National University. It was not until 1970 that I realised one had to allow for non-coincidence of *g* and *A* matrices to fit the spectrum. A paper by van Rens, Keijzers and van Willigen on Cu^{2+} in selenocarbamates that appeared in *J. Chem. Phys.* 52, 2858 (1970) provided the confirmation that I was looking for, that such non-coincidences were real. Blakley and Winfield had also recorded a strange two line spectrum that later turned out to be due to Co-radical pairs formed during enzyme reactions with co-factor B_{12} where only the 'radical' part of the spectrum was observable. In the late '70's we managed to determine the Co-radical distance to be ~10 Å using our dissimilar coupling dimer model. Buettner and Coffman at the University of Iowa independently came to the same conclusion.

The Physics Department hosted a number of sabbatical visitors from the Clarendon Lab for many years, though only Michael Baker in 1969-1970 was directly involved in EPR. He presented lectures on coupled systems and wrote a fine review for *Reports in Progress in Physics*.

Apart from on-going collaboration with Chemistry colleagues for more than 40 years, my own work continued in solid state, phase transitions, Jahn-Teller effect, asymmetries in spectral lines, implications of low symmetry, the connection between field and frequency-sweep, and the development of an integrated S-band microwave bridge. With the advent of a Bruker ESP380E spectrometer in 1993, my group, consisting of many talented PhD students and postdocs, pursued pulsed EPR including exploration of six-pulse sequences and other options.

During the early 1980's, Graeme Hanson, then a Chemistry PhD student of Dr. Tony Wedd [7] at La Trobe University in Melbourne, took advantage of our facilities, particularly the S- and L-band bridges and ready availability of liquid helium, to resolve ligand hyperfine interactions in oxomolybdenum(V) complexes which were early models for the active sites in mononuclear molybdenum enzymes. At the same time, he became interested in generalising simulation software. On returning from a post-doctoral stint at the Harvard Medical School, where he used EPR to structurally characterise cobalt(II) substituted carboxypeptidase, its catalytic intermediates and resting complexes, he spent about 18 months as a postdoc in my group before moving to the University of Queensland. Graeme collaborated with my PhD student, Geoff Sinclair, in writing menu-driven simulation software for LSI-11 and VAX computers. It was not surprising to me that Graeme and his team in Brisbane eventually developed the *Sophe* interpolation scheme (with a former PhD student from China, Deming Wang) and *XSophe* and *MoSophe* commercial software packages (with another former student of mine, Chris Noble).

Research involving EPR spectroscopy has produced some 30 PhD's in Physics. In addition, through collaboration with Inorganic Chemistry colleagues at Monash, there were another 20 or so PhD's using EPR. The collaboration with Prof. Tony Wedd [then at La Trobe University, but since 1990 at the University of Melbourne] produced two PhD's, one of whom was Graeme Hanson.

A new chapter has begun at Monash through the appointment of Professor Harald Schmidt as Head of the Department of Pharmacology. Together with new optical techniques (near-infrared, NIR), and new antibody-based contrast agents for classical imaging modalities such as MRI, EPR and Overhauser-enhanced MRI (OMRI) may play key roles in advancing the portfolio of molecular imaging (MI) modalities for cardiovascular and inflammatory disease triggers such as oxidative stress. Important cross-validation between different MI techniques such as EPR/NIR and OMRI/NIR imaging may be achieved by hybrid contrast

agents for more than one technique. These technologies may contribute to the elucidation of disease mechanisms, identification of new drug targets and early diagnosis of patients at risk. While awaiting the arrival of his own equipment, Professor Schmidt has recently undertaken preliminary experiments at Bruker in Germany.

OTHER AUSTRALIAN UNIVERSITIES

Australian National University (ANU), Canberra

A. J. L. (Athel) Beckwith, a Fellow of both The Australian Academy of Science and The Royal Society of London, earned a high reputation for applications of EPR to free radicals. He first used EPR at the University of Adelaide (1961-1981) and then from 1981 at the Research School of Chemistry, ANU where he is Emeritus Professor.

Beckwith's interest in organic free radicals began in 1952 during his honours year at the University of Western Australia (UWA) and continued during doctoral studies at Oxford. He became convinced that these transient species are involved as intermediates in a number of commonly used synthetic reactions and that they had great potential for the development of useful new reactions. The problem was that one always had to deduce their intermediacy. On learning from R. O. C. (Dick) Norman [8] that he could generate simple organic species such as $\bullet CH_2OH$, and hence directly observe them in solution by ESR spectroscopy, Beckwith spent 1968 on sabbatical with Dick Norman at the University of York where he set about seeing whether he could generate and observe aryl radicals. The flow method involving diazonium salts and titanous ion worked wonderfully and although the initially generated aryl radicals could not be observed, other radicals formed from them were. On his return to Adelaide, the University of Adelaide and the newly formed ARGC [9] agreed to fund the purchase of a Varian E9 spectrometer which was installed in 1969. The flow method was applied to the following problems: 1. Generation and detection of free aryl radicals in aqueous solution; 2. Observation of radicals formed by cyclisation or rearrangement of suitably substituted aryl radicals; 3. Investigation of the rearrangement of V-acyloxyalkyl radicals which revealed that it involves a concerted mechanism proceeding through a cyclic transition structure; 4. Determination of the spectral properties and reactions of various phosphorus containing radicals; and 5. Determination of the mechanism of cyclo-polymerisation processes.

When he moved to the ANU in 1981, Beckwith obtained a Bruker instrument and began to use photolytic methods for radical generation. This enabled more accurate determination of splitting constants, and elucidation of the stereochemistry and conformational stability of radicals. ESR was also employed for the accurate determination of radical reaction kinetics. Further ESR methods were also developed for the precise determination of the structure, stereochemistry and reactivity of radicals, and the information so obtained was applied to probe the electronic and steric factors controlling reactivity, and to devise useful new synthetic reactions.

Dr. Richard Bramley's group in the Research School of Chemistry at ANU studied short-lived excited states by ODMR. With aromatic carbonyls a definitive test for the n-π or π-π triplet character was found, using the g-factor with B along C=O to obtain the spin-orbit component of the ZFS leaving the dipole-dipole part for the assignment. Zero field splittings up to 20 cm^{-1} were found for deutero-xanthones. In molecular crystals, kinetic parameters for radiative and non-radiative decay, relaxation and polaron hopping were determined. Optically detected zero-field EPR in the range 1–26 GHz, using tuneable loop-gap resonators, was developed and applied as well to ground state transition metal ions leading to considerably greater accuracy in Hamiltonian parameters and the resolution of sites not seen in high field EPR. Construction of a pulsed EPR spectrometer in the late 1980's facilitated further work on short-lived species, fullerenes, high temperature superconductors, and metal ion catalyst sites.

Prof. Rainer Grün, from the ANU Research School of Earth Sciences, studied at the Universität zu Köln, where he was awarded his Diplom in 1982 and his Doctoral Degree in 1985. He then firstly undertook postdoctoral research in Canada under the supervision of Henry Schwarcz. In 1987, he took over the Luminescence Dating Laboratory at the University of Cambridge. In 1992, he was appointed as the Head of the Radiocarbon Dating Laboratory at the ANU where he was instrumental in widening the expertise of the laboratory into luminescence and ESR dating where, during the past 15 years, it has been one of the most productive and innovative ESR dating laboratories in the world. Geochronological research requires multi-disciplinary knowledge, spanning from geology and physical geography to basic processes in physics and chemistry, mathematical and statistical modelling, and applications in Archaeology and Palaeoanthropology. Prof. Grün has publications in all of these fields. He has initiated and was involved in almost all innovations in ESR dating over the last twenty years, particularly in applications to archaeology and human evolution. More recently, Prof. Grün has branched out into isotope analysis for the reconstruction of diet and migration patterns of ancient humans as well as the environmental conditions of early human settlements. In 2008, he was elected Fellow of the Society of Antiquaries of London, and the Australian Academy of the Humanities for his contributions to archaeological sciences.

Prof. Grün is the Editor-in-Chief of *Quaternary Geochronology*, which he founded in 1993, first as part of *Quaternary Science Reviews* and, since 2006, as a stand-alone journal published by Elsevier.

Professor Czeslaw Rudowicz spent 1982-1989 as a Research Fellow in Bramley's Group, working mainly on theoretical foundations of EMR (EPR/ESR) spectroscopy of transition ions, including, ligand/crystal field theory, microscopic spin Hamiltonian theory, the superposition model and low symmetry effects. He also interacted with both Bramley and another Research Fellow, Stephen Strach. Rudowics has recently returned to Poland after many years as a Professor of Physics at the University of Technology in Hong Kong.

A Varian E-12 Q-band spectrometer was purchased c.1972 by Professor Alan Runciman [10], then Head of Solid State Physics in the Research School of Physical Sciences at the ANU. Much of the early work was carried out by Dr. Andy Edgar from NZ, now at Victoria University in Wellington. Professor Neil Manson and his Group, while mainly concerned with high resolution optical spectroscopy of solids, have recently used the spectrometer to investigate colour centres in diamond and silicon carbide as possible vehicles for quantum information processing.

Dr. Ron Pace, from the Department of Chemistry, Faculty of Science at the ANU, has long used EPR in studies of the Oxygen Evolving Complex (OEC) in Photosystem II. ESEEM studies of PSII during functional turnover have been carried out recently with colleagues in the UK. The spectroscopy is complemented by computationally derived

quantities from the DFT modeling of the cluster.

Sydney University, School of Chemistry

Professor Peter Lay applies the power of EPR to unravel the bioinorganic chemistry of drugs and carcinogens, particularly to understand the bioinorganic chemistry of chromium carcinogens (one of the most important occupational and environmental carcinogens) and chromium dietary supplements (the second most consumed metal supplements after Ca supplements). The sharp signals of Cr(V) intermediates have proved instrumental in understanding the metabolism of the carcinogens and drugs in biological media, cells and live animals, particularly the mechanisms of Cr-induced genotoxicity, anti-diabetic effects and potential cancer risks of Cr dietary supplements. Recent work involves V(IV) bioinorganic chemistry [2, 8] because of the increasing interest in the potential use of V(IV) complexes as anti-diabetic drugs. They have used EPR spectroscopy in the development of Cu complexes of anti-inflammatory drugs, used in veterinary applications for the treatment of arthritis and leg inflammation in dogs and for leg inflammation in racehorses. This year, Peter Lay was rewarded with Fellowship of the Australian Academy of Science.

University of New South Wales (UNSW), Sydney

Professor Russell Howe carried out EPR of catalysts for many years in the School of Chemistry, before moving to the University of Aberdeen, Scotland. From the 1960's until the 1980's, the late Professor Dan Haneman from the School of Physics used EPR to study semiconductors, work that earned him Fellowship of the Australian Academy of Science.

University of NSW at the Australian Defence Force Academy (ADFA), Canberra

Physicist Dr. Wayne Hutchison provides the magnetic resonance node for the distributed Australian Centre for Quantum Computer Technology, undertaking measurements on spin systems which have potential application as spin based quantum computers (QC), particularly phosphorus in silicon. Construction of a pulsed ESR system that operates in conjunction with a He^3-He^4 dilution refrigerator and superconducting solenoid magnet down to millikelvin (mK) temperatures, permitted, for example, measurement of the longest reported coherence times for phosphorus donors in natural silicon of ~4 ms. Conventional field swept CW-ESR is used to investigate large area implants produced via implantation of P^+ and P^{2+} at the University of Melbourne.

Macquarie University, Sydney

Dr. Louise Brown and her group use a variety of biophysical spectroscopy techniques to determine the structure of proteins and to investigate conformational changes that accompany protein function. Site-Directed-Spin-Labeling EPR Spectroscopy (SDSL-EPR), an important tool for determining the structure of proteins which are not amenable to the traditional atomic resolution structural techniques of NMR or X-ray crystallography, is used, for example to investigate the structure of the muscle-Troponin complex and to probe the structure of ion channels in membrane bilayers.

Melbourne University

Associate Prof. Charles Young and Prof. Tony Wedd from the School of Chemistry investigate trace metals essential to life for enzymes, but highly toxic in excess, where the balance between deficiency and toxic excess must be maintained. EPR is one among many characterisation techniques involved in investigations of metals in biological and artificial catalysis. and applications involving synchrotron radiation. Their interest in transition metal chemistry stems primarily from a desire to understand the structure and function of biological (enzymatic) and artificial (industrial) catalysts. Molybdenum, an essential trace element for all forms of life, is found at the active site of pterin (MPT)-containing enzymes. Recent work concerns the copper regulatory and transport pathways and within this area the properties of the protein PcoC (CopC) have been examined using both CW and pulsed EPR (in collaboration with John Boas, Simon Drew and the author).

My last PhD student, Dr. Simon Drew, currently works at the University of Melbourne within a team of Molecular and Cell Biologists, Chemists and Biochemists from The Department of Pathology, The Bio21 Molecular Science and Biotechnology Institute, the Mental Health Research Institute and the Centre for Neuroscience. His research is focused on the Bioinorganic Chemistry of metal-protein interactions that underlie the pathogenic mechanisms of various neurodegenerative diseases, such as Alzheimers, in addition to their therapeutic inhibition. CW and pulsed EPR is carried out in the School of Physics at Monash University. Dr. Drew maintains on-going collaborations in transition metal EPR with the School of Chemistry, Melbourne University, and the Centre for Magnetic Resonance at Queensland University. Dr. Cyril Curtain (mentioned earlier), at the age of 80, is also involved in the above research but nowadays concentrates on X-ray and neutron scattering.

University of Western Australia (UWA), Perth

The earliest ESR experiments at UWA were probably carried out by Dr. Frank Hewgill, Department of Chemistry, who was interested in the oxidation of phenols especially concerning anti-oxidant activity in foods. Much of his early work with ESR spectroscopy, using a Varian 4502 spectrometer purchased in the mid-1960's, involved collaboration with a former student, Dr. Doug Hewitt. In 1983, Hewgill and K.-H. Wywoll from the UWA Geography Department applied EPR dating to emergent Pleistocene mollusk shell carbonate samples. Dr. Allan McKinley, originally from NZ, was appointed to the Department in 1993, inherited the V4502 as Hewgill was about to retire, and added a high vacuum system for matrix-isolation EPR experiments at 4 K. In 1995, Allan obtained a Bruker ESP350 for EPR and CW-ENDOR, which remains the workhorse at UWA today. Research involving ESR ranges from Andrenodoxin in human placentas, ions and small high-spin radicals in solid neon at 4 K, to photo-catalytic radicals produced by UV-irradiation of zinc oxide nano-particles used for sunscreens.

University of Tasmania, Hobart

Using a JEOL spectrometer from the 1960's, firstly Dr. Peter Smith and then Dr. Michael Hitchman, from the Chemistry Department, undertook EPR of transition metal ion systems. Dr. Hitchman is recognised internationally for his research work mainly on the Jahn-Teller effect in copper complexes. Albert Goede of the Geography Department dated stalagmites and shell samples from middens using EPR by measuring free radical concentrations, while Dr. Christian Narkowitz of the Biochemistry Department has used EPR to study superoxide in biological systems. Dr. Jan van Moort from the Geology Department employed EPR for characterisation of gold mineralisation in weathered terrain.

The University of Queensland, Brisbane University

Department of Chemistry: Dr. Peter Pomery and the late Prof. Jim O'Donnell from the Chemistry Department (now the School of Molecular and Microbial Sciences) developed international reputations studying the formation and breakdown of polymeric materials using a Bruker ER200D spectrometer. They combined FTIR and EPR in characterising the radical intermediates formed during the synthesis of polymeric materials. Prof. Curt Wentrup employed EPR spectroscopy in conjunction with matrix isolation to characterise carbenes and nitrenes used in organic synthesis. Assoc. Prof. Lawrence Gahan, in conjunction with Graeme Hanson, employed EPR spectroscopy to characterise mono- and di-nuclear transition metal ion complexes as models for enzyme active sites and mono- and di-nuclear copper cyclic peptide complexes. Assoc. Prof. Mark Riley, a PhD student from the Hitchman group, has continued studies of Jahn-Teller distorted Cu(II) complexes and has built a highly sensitive MCD spectrometer for metalloprotein studies. A group consisting of Gahan, Riley, Hanson and Dr. Gary Schenk currently employ EPR/MCD and optical spectroscopy for the characterisation of di-nuclear metallohydrolases such as purple acid phosphatase, GpdQ and exonuclease.

Prof. Graeme Hanson established EPR at the Centre for Magnetic Resonance (CMR) in 1990 and today has by far the best equipped EPR laboratory in Australia. Facilities include an X- and Q-band ELEXSYS 580 Pulsed EPR, ENDOR and ELDOR, and an ELEXSYS E500 (upgraded Bruker ESP300 instrument) with S-, X- and Q-band bridges, field and frequency calibration, a variety of resonators and low temperature capabilities for all three frequencies. The major research interests of the Hanson Group involve CW and pulsed-EPR spectroscopy applied to the characterisation of paramagnetic materials, with special emphasis on spectral analysis, particularly for metal binding sites in metalloproteins and transition metal ion complexes.

Hanson's Group has been responsible for the development of two different commercial software EPR simulation packages: *XSophe-Sophe-XeprView Computer Simulation Software Suite*, available from Bruker BioSpin, which leads to the determination of spin Hamiltonian parameters from isotropic, randomly oriented and single crystal continuous wave electron paramagnetic resonance (CW EPR) spectra from radicals and isolated paramagnetic metal ion centers or clusters found in metalloproteins, chemical systems and materials science. The more recent package *Molecular Sophe Computer Simulation Software Suite* is an integrated computer simulation software suite based on molecular structure, which has the capacity to revolutionise 3-D molecular characterisation of paramagnetic materials using CW and pulsed EPR and pulsed ENDOR spectroscopy.

At CMR, multifrequency CW-EPR and pulsed EPR has been used to characterise metal binding sites in molybdoenzymes (xanthine oxidase, DMSO reductase, DMS dehydrogenase), iron sulfur proteins (lactyl dehydratase, Giardia ferredoxin), metallosubstituted enzymes (carboxypeptidase A, phospholipase C) and marine cyclic octapeptides. In conjunction with Assoc. Profs. Lawrence Gahan, Mark Riley, Dr. Gary Schenk and Prof. Peter Comba (University of Heidelberg) EPR/MCD, optical spectroscopy and DFT calculations are employed in the the characterisation of di-nuclear (Fe^{III}-M^{II}, Mn^{II}-Mn^{II}, Ga^{III}-Cu^{II}; M = Fe^{II}, Zn^{II}, Mn^{II}, Cu^{II}, Ni^{II}) metallohydrolases such as purple acid phosphatase, GpdQ and exonuclease. Over the years, many important insights into the geometric and electronic structure of these metal ion centres has been elicited through CW EPR and DFT studies of mono- and di-nuclear transition metal ion (Fe^{III}, Mn^{II}, Cu^{II}, Ag^{II}, Mo^{V}, W^{V} and Cr^{V}) ion model complexes as models for the active sites found in metalloenzymes and cyclic peptides.Purple acid phosphatase from sweet potato is the first reported example of an enzyme containing binuclear Fe-Mn centres where the spectroscopic data strongly indicate the presence of Fe(III)-Mn(II) centres at the active site. Of particular interest is the ability of di-nuclear Cu^{II} cyclic peptides to fix carbon dioxide which has and is being studied through a combination of a wide range of mono- and bi-nuclear copper(II) cyclic peptide complexes that have been characterized by means of multifrequency CW and pulsed EPR spectroscopy, mass spectrometery, optical absorption, spectroscopy and CD, molecular modeling and DFT calculations in an international collaboration with Lawrence Gahan and Peter Comba. Variable temperature multifrequency CW EPR spectroscopy, in conjunction with computer simulation, has been employed to characterise mono- and binuclear high spin Fe(III), Mn(II) complexes and copper(II), silver(II), molybdenum(V), tungsten(V) and chromium(V) complexes.

James Cook University, Townsville (in Australia's tropical North)

Dr. Rheal Towner, who returned to Canada about five years ago, carried out EPR over more than a decade, including in vivo assessment of nodularin-induced hepatotoxicity in the rat using magnetic MRI, MRS and EPR Oximetry. Today, Brian McCool uses EPR, amongst other methods, supplemented by Quantum Mechanical calculations, to investigate crystalline molecular assemblies whose structures are known from X-ray diffraction. Where appropriate, metal centres are incorporated and the magnetic interactions between them studied using EPR.

HEART RESEARCH INSTITUTE, SYDNEY

Professor Michael Davies, the Deputy Director, brought EPR to the Institute in the late 1990's. Mechanisms of modification of biological molecules (primarily proteins and complex carbohydrates by reactive species, both radicals and excited state species) are investigated using multiple methods with EPR spectroscopy being the major method for detecting and characterising intermediate radicals. Due to the low levels of radicals generated in many biological systems and the high reactivity of many of these species, EPR spin trapping, freeze-quenching/low temperature EPR, direct detection (particularly for highly stabilised protein-derived phenoxyl radicals and semi-quinones) and immuno spin-trapping are all employed. Reactive intermediates are also investigated by other methods, typically HPLC separation of native and modified materials and characterisation and quantification by a wide range of techniques including UV/VIS, fluorescence, electrochemical, radiometric and MS detection. The aim is to apply this information to more complex systems such as human pathologies, particularly heart disease. Michael Davies was awarded the 2003 IES Silver Medal for Biology/Medicine.

AUSTRALIAN RADIATION LABORATORY

The major part of Dr. John Boas's career was spent at the Australian Radiation Laboratory (ARL), now called ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) where he was concerned with radiation monitoring and standards. John established both EPR (with a Bruker ER200D) and Optical Spectroscopy at ARL operating down to liquid helium temperature. The EPR spectrometer was used for studies of rare-earth doped $CaSO_4$ as a potential thermoluminescent dosimeter, pilot studies for

International Symposium on Electron and Nuclear Magnetic Resonance, Monash University, August 1969. (Far right, kneeling is Charles Slichter. John van Vleck is second from the right in the second row. Photographer, R. L. Bryant.

Conference Photo EPR 95, University of Sydney, August 1995.

EPR dosimetry with alanine and for studies of Tc complexes relevant to radiopharmaceutical chemistry. He retired from ARPANSA in 2000 and was appointed an Honorary Research Fellow in Physics at Monash where he remains active today.

EPR AND EPR-RELATED CONFERENCES

Early in 1967, Dr. Clive Coogann, an NQR spectroscopist at the neighbouring CSIRO Divison of Chemical Physics, invited me to be Secretary to the Organising Committee for a Symposium on Electron and Nuclear Magnetic Resonance to be held at Monash University during August 1969, in succession to earlier meetings that had taken place in Brazil and Japan. About half of the ~200 participants were from overseas. John van Vleck gave a most memorable After-Dinner Speech involving interesting historical anecdotes concerning magnetic resonance as a real father of the field. Plenary Lecturers included Herb Gutowsky, Charles Slichter, Ray Orbach (now Director of DOE in the US), Bill Hayes, Raymond Andrew, John Waugh, Alan Carrington, David Ingram and William Low to name just a few. At an open forum at the end of the Symposium, a committee chaired by Daniel Fiat was set up to establish what is now known as ISMAR. I note that the meetings held in Brazil, Japan and Australia are counted as the first three ISMAR conferences.

EPR 95 (August 1995)

Graeme Hanson and I organised the Satellite Meeting, EPR 95, devoted to EPR which took place prior to ISMAR 95 at the University of Sydney. Amongst the ~50 participants who attended were Keith McLauchlan (then President of IES), Wolfgang Lubitz, Jack Freed, Betty Gaffney, Peter Höfer, Gerd Kothe, Larry Kevan, Riccardo Basosi, Czeslaw Rudowicz and Daniela Goldfarb and many others well-known in the EPR community. They should be easily recognised as they are mostly in the front row of the Conference Photo.

APES 2008

Michael Davies, Graeme Hanson, and I were CoChairs of APES 2008 held in Cairns this year. This is covered in a separate report by Michael Davies (p. 33).

ANZMAG (Australian and NZ Magnetic Resonance Society)

ANZMAG, established in 1995, holds conferences roughly every two years. However, EPR has played a relatively small part at ANZMAG conferences, not surprising given the size of the NMR community in Australia. International EPR lecturers include the late Arthur Schweiger (1997), Larry Berliner, Gerd Kothe and Ron Mason (2000), Jack Freed (2004) and Wolfgang Lubitz (2006).

ACKNOWLEDGEMENTS

I would like to acknowledge my Monash colleagues, Gordon Troup and Don Hutton (dec. 2007) with whom I shared laboratory facilities for many years, and Tom Smith (dec. 2002). John Boas, a friend and colleague for more than 43 years, remains more active than I am these days.

I must also acknowledge sabbatical hosts in the USA. In 1971 I spent time with both the late Max Rogers at Michigan State and Linn Belford, at the University of Illinois, from whom I gained important insights regarding electronic structure of paramagnetic ions in low symmetries. I spent 1979 at the National Biomedical ESR Center in Milwaukee and had spent many many conversations hours with Jim Hyde trying to figure out the connection between field-swept and frequency-swept EPR with Jim Hyde, a problem something that I did not resolve until 1981 two years later.

Finally I wish to thank those many colleagues who provided background information for this article, and especially to Graeme Hanson, John Boas and Laila Mosina for reading several versions of this article as it was being prepared.

Melbourne, Australia

Footnotes

1 I recall that after a certain amount of some theoretical analysis, Heine'sHein's MSc thesis concluded with something like, 'Clearly this problem is too difficult'! Heine moved to Cambridge, where he became a distinguished Theoretical Physicist and Fellow of the Royal Society.
2 Commonwealth Scientific and Industrial Organisation, the Australian Government's scientific organisation.
3 My MSc supervisor in NZ, Tom Seed, obtained a copy of the circuit from Bogle and thus I was able to construct my own stabiliser for the spectrometer I built that year at the University of Canterbury in 1960.
4 Later known by several different names such as Chemical Technology & Chemical and Wood Technology.
5 Blakley moved to the University of Iowa in 1969 and later to St Jude's Hospital in Tennessee.
6 A laboratory famous for the discovery in 1952 of Atomic Absorption Spectroscopy as an analytical tool by the late Sir Alan Walsh. This discovery led to the establishment of a company, Techtron, later taken over by Varian and now known as Varian Australia.
7 Tony Wedd became Professor of Inorganic Chemistry at Melbourne University in 1991.
8 The late Professor Sir Richard Norman, Professor of Chemistry, University of York and UK Chief Defence Scientist (UK).
9 Australian Research Grants Committee, now known as the Australian Research Council or ARC.
10 Alan Runciman, came to the University of Canterbury in 1958 from Harwell, then went to MIT in 1961 and back to Harwell ~1965 for some years before taking up a Professorship at the Australian National University. It was Alan who gave me about 30 seconds early in 1960 to decide whether to do EPR or Optical Spectroscopy. I chose EPR!!

Tips & Techniques

Workshop on Quantitative EPR

Dave Barr, Sandra S. Eaton, and Gareth R. Eaton

At the 31st Annual International EPR Symposium, Breckenridge, Colorado
July 27, 2008

Additional contributors to this Workshop include
Ralph T. Weber, Patrick Carl, Peter Höfer, Richard W. Quine, George A. Rinard, Bruce Robinson and Colin Mailer

The Need for Quantitative EPR

There is a growing need in both industrial and academic research to provide meaningful and accurate quantitative results from EPR experiments. Both relative intensity quantification and the absolute spin concentration of EPR samples are often of interest. A workshop was held at the 31st International EPR Symposium to describe and discuss the various sample-related, instrument-related and software-related aspects for obtaining useful quantitative results from EPR experiments. Some specific items discussed included: choosing a reference standard, resonator considerations (Q, B_1, B_m), power saturation characteristics, sample positioning, and finally, putting all the factors together to provide a calculation model for obtaining an accurate spin concentration of a sample.

Even if the question is simply "is there a radical present?" you need to know, e.g., whether <1% or 100% of the species are in the radical form or in a particular metal oxidation state. There are many examples in the literature in which an impurity or a slight dissociation resulted in the EPR signal observed.

Among the common type of measurements for which intensity quantitation is essential include:

- How many spins are there in a biological sample?
- What is the spin state of a metal complex as a function of temperature?
- What is the age of an archeological artifact?
- What is the radiation dose?
- What will be the shelf life of foods and beverages?

Line width quantitation is essential for:

- Oxymetry
- Molecular motion
- Relating line width to relaxation times and hyperfine couplings.

Magnetic field quantitation is essential for:

- Measurement of g values
- Measurement of hyperfine splittings
- Comparison of g or hyperfine splittings with computation of these parameters.

Parameters Affecting EPR Quantitation

Each term in the expression for EPR signal voltage must be kept in mind during EPR measurements:

$$V_S = \chi'' \eta Q \sqrt{PZ_0}$$

The Workshop discussed in detail the spin susceptibility, χ''; the impact of the sample on the filling factor, η; the resonator Q; and the selection of microwave power, P. In addition, examples were selected to show how the EPR line shape depends on the modulation amplitude and frequency and on the filter time constant.

What Matters, and What Can You Control?

Many spectrometer and sample parameters and interactions between the sample and the spectrometer affect the quantitative accuracy. Some of them can be controlled by the operator. Others cannot be controlled by the operator, but need to be known to accurately perform quantitative measurements. For example,

- The operator can control the preparation of the sample.
- The operator can select a sample and a resonator (see 2005 Workshop on Selecting an EPR Resonator) such that there is minimum perturbation of the microwave fields in the resonator. However, the resonator Q must be measured for accurate comparisons.
- The operator can make the calibration standard such that its width, intensity, and dielectric loss are similar to the unknown.
- The operator rarely can control the relaxation properties of the sample, but has to be sure that the signal is not power-saturated when making quantitative comparisons, or, at least, is saturated to the same extent as the standard.

The list of variables to consider is long, but the operator must always keep these in mind, and control or measure as many as possible, including:

- Microwave power and B_1 at the sample
- Modulation amplitude
- Gain
- Scan time and detector time constant
- Magnetic field scan width
- Type of cavity
- Properties of any Dewar insert in the cavity (B_1 depends on the Dewar wall thickness)
- Physical size of sample
- Sample position in the cavity
- Dimensions and uniformity of the sample tube
- Dielectric properties of the solvent at the microwave frequency (see 2002 Workshop)
- Detector current
- AFC offset
- Temperature of the sample and its effect on sample concentration, species dissociation, paramagnetism, and dielectric loss.
- Microwave frequency (and magnetic field)

The Workshop concluded with the 10 Commandments of Quantitative EPR:

1 Thou shalt prepare samples carefully.
2 Thou shalt subtract background signals.
3 Thou shalt consider microwave loss.
4 Thou shalt not saturate thine spectra.
5 Thou shalt consider effects of modulation on spectra.
6 Thou shalt adjust microwave phase accurately.
7 Thou shalt allow the spectrometer to achieve thermal equilibrium.
8 Thou shalt calibrate the magnetic field.
9 Thou shalt know resonator Q.
10 Thou shalt calibrate microwave power and B_1 at the sample.

The PowerPoint presentations used in the Workshop will be available for download from the Bruker web site.

EUROMAR 2008

St. Petersburg, Russian Federation, July 6–11, 2008

The EUROMAR 2008 conference took place in the St.Petersburg Scientific Center of the Russian Academy of Sciences and the St.Petersburg State University. It was jointly organized by the Boreskov Institute of Catalysis, Novosibirsk, the St. Petersburg University and the St. Petersburg Scientific Center of the Russian Academy of Sciences and attracted about 500 scientists from all fields of magnetic resonance, such as high-resolution NMR, solid-state NMR, MRI, dynamic nuclear polarization (DNP) and EPR.

EPR was very visible at the conference: with two plenary lectures, two parallel sessions with eight talks and more than 60 posters it made up 15–20% of all contributions. Especially the presence of many researchers from Russia and other East-European countries made up this good representation of EPR at this conference, so that a critical mass of scientists from EPR was guaranteed in the lectures as well as at the poster sessions which was organized in the long hallway of the Twelve-Colleges building of the university, leading to a lively discussion. That is something, which is usually not granted for EUROMAR and similar MR conferences.

Wolfgang Lubitz (MPI Mülheim) gave a very nice introduction into the potential of modern EPR (high-field, ENDOR and pulse EPR) applied to the Mn-complex of photosystem II. In the second EPR plenary lecture Gunnar Jeschke (ETH Zürich) presented very nice results of the PELDOR method and demonstrated their value for structural constraints in macromoleculs. Klaus-Peter Dinse (TU Darmstadt) showed applications of EPR spectroscopy to fullerenes with encapsulated atoms, incorporated into carbon nanotubes, an interesting system for material sciences because of its unusual physical properties. Unfortunately Brian Hoffman (Northwestern University) could not attend the meeting. Other EPR talks were presented by Pavel Baranov (St. Petersburg), Yuri Tsvetkov (Novosibirsk), Sabine Van Doorslaer (Antwerp) , Thomas Prisner (Frankfurt), Elena Bagryanskaya (Novosibirsk), Alexander Schnegg (Berlin) and Malte Drescher (Konstanz). Giuseppe Sicolli (CEA-Grenoble) won one of the three Wiley prizes for his very nice PELDOR investigations on spin-labeled DNA (*Angewandte Chemie* 2008).

The conference was very interesting not only from the EPR point of view but also from the obviously growing connectivity to many methods in NMR, as DNP, residual dipolar coupling (RDC) in liquids and recoupling methods in solid state (REDOR), paramagnetic relaxation enhancement (PRE), microscopy and single-molecule detection.

After the long scientific sessions is was a pleasure to see the wonderful city in the 'white nights', visit the impressive Hermitage or Petergof, enjoy a concert given by Dieter Michel (Leipzig, organ), Uwe Eichhoff (Rheinstetten, flute), Vladislav Pesin (St. Petersburg, violin) and Sergei Zarubin (St. Petersburg, viola), and the conference dinner. All together it was a very enjoyable and scientifically successful conference.

Thomas Prisner,
member of the EUROMAR 2008
Program Committee

6th Asia-Pacific EPR/ESR Symposium (APES 2008)

Cairns, Australia, July 13–18, 2008

This series of meetings started in 1997 in Hong Kong under the guidance of Prof. Czeslaw Rudowicz, the founding President of the Society. Since then meetings have been held every 2 or 3 years at various venues around the Asia-Pacific region: Hangzhou (1999), Kobe (2001), Bangalore (2004) and Novosibirsk (2006). This meeting is designed to bring together scientists from nations on the Pacific rim, particularly from Asia [China, Hong Kong, Japan, South Korea, India, Vietnam], Russia, Australia and New Zealand and also from other parts of the world including the USA, Europe and Africa.

The Cairns Convention Centre, which is located in tropical north Queensland, was chosen as the venue for APES 2008 for its high quality facilities and easy access from outside Australia, together with a few other attractions (e.g. golden sandy beaches, the Great Barrier Reef and World Heritage Rainforest, great restaurants).

The conference began on the 13th July with a workshop entitled "Workshop on Multifrequency EPR: Applications to Complex Systems" which was designed to provide a series of introductory lectures into the application of multifrequency EPR in diverse areas from physics through chemistry to biology and medicine. These lectures were given by a range of international speakers from as

From left to right: Graeme Hanson, Sushil Misra and Lawrence Berliner.

far a field as Japan, Europe and the USA, complemented by a couple of Australians. Following the workshop, the meeting was officially started with a welcoming address and spectacular and highly impressive performance by a group of Aboriginal performers. The scientific program then started with a plenary lecture from Graham Smith (UK) followed by a welcome reception.

The succeeding days presentations consisting of oral and poster sessions which addressed the application of high resolution EPR spectroscopy and imaging to quantum computing, advanced materials, photosynthesis, biological-, inorganic- and organic-chemistry, and medicine. On the Tuesday evening the day was concluded with the Annual General Meeting of the Asia-Pacific EPR society and a subsequent poster session. Wednesday morning featured the award of the 2008 Silver Medal in Instrumentation of the International EPR Society, presented by the IES President, Prof. Wolfgang Lubitz, to the President of the Asia-Pacific EPR Society, Prof. Hitoshi Ohta. Following Prof. Ohta's award lecture, the inaugural Young Scientist's Awards of the Asia Pacific EPR Society were presented to two outstanding awardees Dr. Simon Drew (Melbourne, Australia; see also p. 8) and Dr. Takanari Kashiwagi (Osaka, Japan; see also p. 8) who undertake research in biological inorganic chemistry and advanced materials, respectively. The morning was rounded off by a session on "EPR in Australia" which honoured, and was dedicated to, Prof. John Pilbrow (Melbourne, Australia) on his retirement from active EPR commitments. For further details on his very notable contributions to the development of EPR both worldwide and in Australia, please see the accompanying article (p. 24). The Wednesday afternoon was free, with many of the conference participants taking advantage of a nearby tropical island (Green Island) to do some swimming, snorkeling or observation of the local fish life.

The sessions on Thursday and Friday followed a similar pattern to Monday and Tuesday and featured a range of further invited and submitted lectures. The Thursday afternoon was concluded with a well-attended Annual General meeting of the International EPR Society (p. 3), and a second poster session. The Friday concluded with a special sake ceremony courtesy of the Platinum Sponsors of the meeting, Jeol, and a highly enjoyable conference dinner, which included live entertainment and dancing (!).

A number of younger (and not quite so young) scientists were supported to attend the meeting by generous contributions from a number of sponsors including Jeol, Bruker BioSpin, Cryogenics and Springer: a trend which the organizers hope will continue for future meetings. A special issue of *Applied Magnetic Resonance* devoted to refereed manuscripts derived from the conference is currently being completed and the volume will appear later this year. Over 100 scientists from four continents and all corners of the world, attended the meeting, and we hope to see them all again, together with new colleagues, at the next (7th) meeting of APES, which is planned to be held on the island of Jeju off southern Korea in 2010.

Michael Davies,
Co-Chair APES2008

The 11th International Symposium on Spin and Magnetic Field Effects in Chemistry and Related Phenomena

St. Catharines, Ontario, Canada, August 9-14, 2009

www.brocku.ca/scm09

Conference Chair: Art van der Est
Department of Chemistry Brock University 500 Glenridge Ave St. Catharines, ON Canada L2S 3A1
Contact:
phone: 905 688-5550 ext 4602
fax: 905 682-9020
e-mail: scm2009@brocku.ca

7th European Federation of EPR Groups Meeting and Closing Meeting of COST P15

Antwerp, Belgium, September 6-11, 2009

www.efepr2009.ua.ac.be

Local organizers: E. Goovaerts (Antwerp), S. Van Doorslaer (Antwerp), Paul Casteels (Antwerp), F. Callens (Ghent), H. Vrielinck (Ghent)
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The 31st EPR Symposium at the Rocky Mountain Conference

Breckenridge, Colorado, July 27–31, 2008

The EPR symposium was held in the beautiful village of Breckenridge surrounded by a gorgeous vista of mountain peaks. The conference was packed with lectures from morning to late at night and was very intense (no room to breathe or sightsee). A workshop on "Quantitative EPR" (organized by Gareth Eaton and Dave Barr, sponsored by Bruker BioSpin) kicked off the meeting and was highly attended. Other sessions included sessions on Spin Labeling (organized by Eduardo Perozo), Spin Trapping (organized by Neil Hogg), Biomechanisms and Metallomolecules (organized by Brian Bennett and Peter Doan), EPR Imaging (organized by Howard Halpern), Material Science and Instrumentation (organized by Alex Angerhofer). A joint EPR/NMR session on Spins in Ordered Aggregates (organized by Glenn Millhauser and Mei Hong) highlighted the contribution of magnetic resonance to understanding the mechanism of amyloid diseases. The discussions were lively and informative. The "Workshop on Pulse Dipolar EPR/DEER Data Analysis" (organized by Gunnar Jeschke and Eric Hustedt) was particularly instructive and intense. One of the highlights of the conference was a session presenting the work of young investigators (organized by Hassane Mchaourab, EPR Chair). Late night sessions at the local brewery were equally enlightening and entertaining.

This year's symposium marked the first time in three decades that the Eatons were not the co-Chairs. The community recognized their service in a special session where Gareth and Sandy were named fellows of the International EPR society. The session was followed by a reception in their honor that was a great success except for the temporary food shortage. The symposium also featured the yearly Lawrence Piette Memorial Lecture (sponsored by Medinox, Inc.) which this year was presented by Neil Hogg from the Medical College of Wisconsin and was entitled "EPR in Hemolytic Disorders: Cell-Free Hemoglobin, Oxidative Stress and the Bioavailability of Nitric Oxide".

The meeting concluded with a banquet to celebrate the 50th Anniversary of the Rocky Mountain Conference on Analytical Chemistry. A lecture on "The Outlook for Energy: A View to 2030" was presented by Todd W. Onderdonk from ExxonMobil Corporation. All participants to the conference were treated to a personal photograph taken with the beautiful mountains in the background in a commemorative wooden frame.

The 51st Rocky Mountain Conference on Analytical Chemistry will take place July 19-23, 2009 at the Snowmass Conference Center and Silvertree Hotel in Snowmass, Colorado. Details will be posted at www.rockychem.com/epr/index.htm.

See you there.

Hanane Koteiche
and Hassane Mchaourab

TAKEN BY RIMMA SAMOILOVA

4th Joint Working Group Meeting of the COST P15 action "Advanced Paramagnetic Resonance Methods in Molecular Biophysics"

Siena, Italy, September 24–26, 2008

The 4th Joint Working Group Meeting and 5th Management Committee Meeting of the COST P15 Action "Advanced paramagnetic Resonance Methods in Molecular Biophysics" took place at the Polo Scientifico di San Miniato, University of Siena 24th-26th of September 2008 with 60 attendees representing 18 countries.

The overall aim of the joint Working Group meeting was to report on the latest developments realized within the three working groups of COST P15 (WG1: *The Development of EPR instrumentation and EPR methodology*; WG2: *Study of paramagnetic metalloproteins and radical centres in biomolecules*; WG3: *Study of biomolecular systems using spin labelling and spin probing*). The WG talks were mixed such that there was a maximum interaction between the different WG participants. Many results were presented that followed directly from the short-term scientific missions (STSMs) performed within the COST P15 Action in the past year. Next to senior scientists, also many PhD students and young post-docs were given the chance to present their results as oral or poster contributions. The presented papers were intensely discussed and new collaborations were initiated during the meeting.

The meeting had one plenary lecture, given by Prof. Dr. Jan Schmidt (University of Leiden), on "*High Frequency EPR and ENDOR spectroscopy of semiconductor nanoparticles*". The International EPR(ESR) Society had chosen the COST P15 meeting in Siena to award Prof. Dr. Jan Schmidt the prestigious Gold Medal for life-long achievements in the field of EPR. The medal was given to Jan Schmidt by Wolfgang Lubitz, who concluded with this act his term as the IES President.

Beside the plenary lecture, four invited lectures were given by the following WG participants: Sun Un (FR) (WG2) "*Applications of Mn(II) high-field EPR in Biology and Chemistry*", Klaus Möbius (D) (WG3) "*Where high-field EPR meets solid-state NMR in biophysics: News from 95 GHz ESEEM, PELDOR and 360 GHz ENDOR or Trace Conformational Changes of Proteins in Action*", José Moura (PT) (WG2) "*EPR and Mechanistic Studies on Mononuclear Mo enzymes*" and Rebecca Pogni (I) (WG2) "*Characterization of transient radical intermediates in the catalytic mechanism of oxidative enzymes: the central role of EPR spectroscopy*".

The remaining 22 talks were promoted from the submitted abstracts. As mentioned before, an emphasis was put on allowing young scientists to present their work. One of the main goals of COST P15 is to provide a forum to young researchers in the field of EPR and to allow them to get in contact with the more senior scientists. From this point of view we believe that the Meeting was very productive. One poster session formed of 21 contributions was scheduled on the 24th. It was frequently visited and many discussions were done. Furthermore, the posters were on display during all the meeting.

The scientific program was accompanied by social events: the City Hall Museum visit (sponsored by Bruker BioSpin and Siena Municipality) and the Social Dinner in a restaurant of Piazza del Campo, the most famous place in Siena where the traditional event "Palio" is run twice a year. During the dinner Tuscany food and wine tasting was catered and a warm appreciation for the efforts of local organizers (Riccardo Basosi, Maria Camilla Baratto and Alessandra Valacchi) was expressed by participants.

The MC meeting was timely in order to plan the activities for the last period of the action and to discuss with the COST officer Caroline Whelan up-coming changes in the COST administration.

Riccardo Basosi
Chaiman of the Siena Meeting
Sabine Van Doorslaer
Chair of COST P15 Action

Jan Schmidt (left) and Wolfgang Lubitz (right).

4th Triennial European EPR Summer School in St. Andrews

St. Andrews, Scotland, Aug 22–Sept 1, 2008

Every three years the European EPR Society organise a major interdisciplinary EPR summer school, whose aim is to introduce a new generation of young EPR spectroscopists to modern EPR techniques and to facilitate future collaboration between European and other International groups. The courses aim to teach young scientists the newest methodological and instrumental developments in EPR spectroscopy along with novel research applications and give them the theoretical tools necessary to understand the various techniques. The first summer school was held in Caorle, Italy in 1999, the second in Retie, Belgium in 2002 and the third in Wiesbaden Germany in 2005.

The fourth school was held in the medieval town of St. Andrews, Scotland and was jointly organised by St. Andrews University and Dundee University and lasted for 9 days from 22nd August to 1st September, 2008. It brought together 21 lecturers – all experts in their field, with 86 students from 21 different countries.

All the students and lecturers were accommodated and fed in John Burnet Hall, a student Hall of Residence, just a stones throw from the Old Course, the oldest golf course in the world, and close to the famous West Sands beach. Modern lecture rooms, seminar rooms and poster space were provided at the Gateway Centre just a hundred yards from the accommodation. The school had over 40 formal lectures, 4 evening guest lectures, 6 different practical sessions and a number of small group tutorials and aimed to provide teaching material for biologists, chemists and physicists from a wide variety of experience and backgrounds.

The school thus commenced with two days of introductory lectures with Prof. Gert Denninger starting the school with a sparkling lecture that introduced resonance phenomena via a number of clever experimental demonstrations. This was then followed by introductory lectures on spin Hamiltonians, relaxation, basic cw and pulse experiments, multi-frequency EPR, instrumentation and key applications in Biology and Physics.

This was then followed by six days of more advanced material that included high-field EPR, cw and pulsed ENDOR, FT-EPR, ESEEM, HYSCORE and other 2-D EPR concepts, more advanced relaxation phenomena, dynamics, transient EPR, ODMR and EDMR, high-spin systems and molecular magnets, modern pulsed instrumentation, computer spectral simulation and molecular modelling, dipolar coupling, spin correlated pairs, spin labelling, DEER and various applications in Chemistry, Biology and Physics.

Computer practical sessions were given on spectral simulations using EasySpin and DFT calculations, and small group tutorials/practicals were provided on ENDOR, introductory and advanced ESEEM, DEER, single crystal measurements and Density Matrix Theory.

Entertaining evening guest lectures included sessions on DNP, EPR Imaging, Quantum Computing and Spin Chemistry.

These formal sessions were supported by a number of open small group tutorials where students could choose to sit and talk to any lecturer on any topic. These proved especially popular, informative and successful.

Dr. James Leggett receiving his poster prize from the President of the European EPR Society, Prof. Etienne Goovaerts

The students also provided posters of their own work, which were all of an extremely high standard. Matthias Fehr (Berlin), James Leggett (Nottingham), and Filip Desmet (Antwerp) all won bottles of whisky for best posters.

With such an intensive education program the school also tried to incorporate a suitably varied social program so the students also had an opportunity to relax and get to know each better. This included various wine receptions, a whisky tasting evening and a day trip to the Highlands visiting both Glamis and Blair Atholl castles followed by a walk along a picturesque series of waterfalls. The school banquet was followed by Scottish country dancing where students and lecturers threw themselves around the dance floor encouraged by a well known local Chelidh band. A Scottish Highland games, also allowed students and lecturers to show off their physical prowess in a variety of events that included "tossing the caber" and "heaving the wellie". The clan led by Prof. Sabine Van Doorslaer eventually proving victorious by winning the final tug of war event. An impromptu tug of war between the women and selected men also saw the women victorious much to their evident delight.

The European EPR Summer School is an event that has always been strongly supported by the senior EPR community in Europe and represents a major commitment and investment in the training of young researchers and building a strong and vibrant international EPR community. Considerable thanks thus must go to all the lecturers who gave up a great deal of their time both to lecture at the school and prepare detailed tutorials, practicals and handouts of all the lectures and made it such an enjoyable event. They threw themselves into all the events with consider-

Lecturers and Students at the EPR Summer School

Tug-of-war at the Summer School Highland Games

able gusto and it was clear from student feedback forms that the quality of the teaching was hugely appreciated. When asked to name the three best lecturers almost every lecturer was mentioned at least once.

Lecturers who contributed included Gunnar Jeschke (ETH Zurich), Sabine Van Doorslaer (Antwerp), Daniella Goldfarb (Weizmann Institute), Klaus Möbius (Berlin), Stefan Stoll (UC Davis), Etienne Goovaerts (Antwerp), Mark Newton (Warwick), David Lurie (Aberdeen), Peter Höfer (Bruker BioSpin), Marina Brustolton (Padova), Robert Bittl (Berlin), Olav Schiemann (St. Andrews), Graham Smith (St. Andrews), Gert Denninger (Stuttgart), Peter Hore (Oxford), David Collison (Manchester), Eric McInnes (Manchester), Martin Spaeth (Paderborn), Peter Dinse (Darmstadt), Walter Kockenberger (Nottingham), Martin Kaupp (Wurzburg) and Sandra Schnizell (Wurzburg).

A special thanks also to all the co-organisers especially Lyn Hynd, Olav Schiemann, David Keeble (Dundee), Paul Cruickshank, Robert Hunter, Duncan Robertson and the rest of the MM-Wave and ESR group at St. Andrews for all their hard work during the event.

The event was also heavily subsidised to allow students from as many different groups as possible to participate. This year vital support was given by SUPA (Scottish University Physics Alliance), SUSSP (Scottish Universities Summer School in Physics), the COST P15 Action, Bruker BioSpin and the EPSRC UK funding council.

Overall, it was clear from feedback from both lecturers and students that it was a very successful event and there is considerable demand for the tradition of European Summer Schools to continue.

Graham Smith
Organising Committee

Market Place

POSITIONS

The University of New Hampshire invites

The Department of Chemistry at the University of New Hampshire welcomes inquiries from PhD scientists at any rank regarding research, and graduate and undergraduate teaching opportunities, in the area of Experimental Physical or Biophysical Chemistry. Candidates with research interests in electron resonance are particularly encouraged. Facilities include Bruker ELEXSYS E500/E560 with X-band CW-ENDOR, and Varian X- and Q-band CW-EPR/ENDOR spectrometers with dispersion and absorption mode detection and temperature capability from 2 to 300 K. The electron resonance lab has a variety of microwave components, bridges, cavities and electronic measuring equipment for instrument construction as well as facilities for biochemical research. Inquiries should include a cover letter explaining the type of research and teaching opportunities desired, a CV, research plans and teaching goals, and should identify three people as references. Send to: Christopher F. Bauer, Chair, Department of Chemistry, University of New Hampshire, Durham, NH 03824 (603) 862-1550 (fax 4278), cfb@cisunix.unh.edu. Inquiries will be reviewed as they are received. UNH supports diversity and strongly encourages women and minority candidates to send an inquiry.

Research Positions - Advanced EPR of Bioinorganic Systems

Several research positions (PhD and Postdoc level) are presently available in the EPR department of the Max Planck Institute of Bioinorganic Chemistry in Mülheim/Ruhr, Germany.

We are looking for highly motivated young scientists in the field of Electron Paramagnetic Resonance who are interested in studying metallo-enzymes and related model systems. The main focus is on the investigation of photosynthetic systems (reaction centers, water oxidation), hydrogenase (biohydrogen production), radical enzymes and protein maquettes.

Our EPR lab is equipped with the full range of modern Bruker EPR spectrometers including E500 CW X-band, E580 CW/pulse X-band, E700 CW/pulse Q-band, and E680 CW/pulse W-band. In addition a high field CW/pulse spectrometer operating at 122 and 244 GHz (fields up to 12 T) is available next to several other CW EPR systems at S-, C-, X- and Q-band. We are using the complete repertoire of pulse and CW EPR techniques (ENDOR/TRIPLE, ELDOR, ESEEM) in combination with laser excitation and freeze quench techniques. More details can be found on our website: www.mpibac.mpg.de/lubitz.html.

The selected persons should have relevant training in Magnetic Resonance Spectroscopy, preferably in EPR. Candidates with an interest in EPR instrumental development and microwave engineering are specifically encouraged to respond.

Please send your application to Prof. Dr. Wolfgang Lubitz, Max Planck-Institute for Bioinorganic Chemistry, Stiftstrasse 34-36, 45470 Mülheim an der Ruhr, Germany

E-mail: lubitz@mpi-muelheim.mpg.de

Postdoctoral or Research Associate position

A position on pulse EPR at the postdoctoral or research associate level depending on qualifications is available at the CNR-INFM

Reader's Corner

Keeping the Flame Burning – Using Magnetic Resonance To Keep Kids Interested in Science (Part Two)

by
Dr. Reef Morse
Professor of Chemistry, Illinois State University (Retired)
Member, Board of Trustees, Steppingstone School

The SMART (Steppingstone Magnetic Resonance Training) Center located in Farmington Hills, Michigan (a suburb of Detroit) now has a web site! It's web address is www.smart-center.org.

This is the site where we will be posting items such as teaching materials, information about the SMART Center, schedules, and the like.

Because the focus of the SMART Center is education and training of students of middle to high school age, one of the requirements for curriculum development is that the presentations be accessible to them – that is, the concepts are presented in terms of experiences a person of that age might have had. For example, I recently devised a lesson for teaching resonance that used objects of the same size and weight (in this case, hardware nuts readily available at the local hardware store) that were suspended on strings of different lengths. One string was kept at a constant length, and the other string was varied in length. The "unit" of measure was the time it took for the system to stop moving after the nuts collided. When done carefully, a plot of settling time vs string length gives the semblance of a Gaussian curve. I was able to present this to 4th and 5th graders (10-11 year olds) and they understood what was happening right away. This lesson is available on the web site.

I'm sure that many of you have presented your work to scientifically naive audiences and have clever methods to explain what you do. If possible, I'd like to include these in the curriculum with appropriate acknowledgment.

Finally, the SMART Center is being run on a shoestring budget. We are trying to equip a basic laboratory at minimum cost. If any of you have older but working laboratory equipment that you can part with, we'd appreciate it. Steppingstone, the parent organization of the SMART Center, is a 501(c)3 non-profit and, as such, can receive donations from educational organizations, or provide tax benefits for donations from for-profit organizations.

Please stay tuned for further progress reports.

MDM National Laboratory, in Agrate Brianza (Milano, Italy). The research activity is related to the pulse EPR/ENDOR investigation of impurities in semiconductors for quantum information processing. The successful candidate must have experience on the pulse EPR/ENDOR techniques possibly connected with the study of semiconductors or insulators, excellent knowledge of solid state physics and quantum mechanics, and good experimental skills. The position is initially for one year, but can be renewed up to five years. For additional information **please contact:** Prof. Marco Fanciulli, marco.fanciulli@mdm.infm.it, tel. +390396036253 (direct), +390396037489 (secretary).

Postdoctoral position at Physics Department, National Dong Hwa University, Taiwan

A postdoctoral position is available in the laboratory of Prof. Shyue-Chu Ke at the Physics Department, National Dong Hwa University, Taiwan. The research will involve the application of EPR and pulsed EPR spectroscopy to understand the fundamental questions related to adenosylcobalamin-dependent enzymatic reactions. Additional information about the laboratory is available at: www.phys.ndhu.edu.tw/teachers/ke/ke.htm. Applicants should have experience in analytical techniques and continuous or pulsed EPR methods and data analysis. Experimental physical chemists with experience in cell culture or synthesis would be beneficial, but is not essential. The position is available this summer and appointments are for up to 3 years. If interested, please send a CV and summary of previous research experience to ke@mail.ndhu.edu.tw.

Tenure-Track Faculty position in Physical Chemistry

The Department of Chemistry at the University of New Hampshire invites applications for a tenure-track faculty position at the rank of assistant professor in any area of Experimental Physical Chemistry. The Department has extensive electron resonance facilities and is active in atmospheric science and nanotechnology. Candidates with expertise in these areas may enjoy significant opportunities for collaboration. The Departmental mission balances research and teaching: A commitment to high quality undergraduate and graduate education, and to establishing a vigorous, nationally-recognized research program, are essential. PhD required. Interested candidates should send curriculum vitae, undergraduate and graduate transcripts, research plans, evidence of teaching proficiency and philosophy, and three letters of recommendation to Christopher F. Bauer, Chair, Department of Chemistry, University of New Hampshire, Durham, NH 03824 (603) 862-1550 (FAX 4278), cfb@cisunix.unh.edu. Review of applications will commence on November 20, 2008. UNH supports diversity among its faculty and strongly encourages women and minority candidates to apply.

Postdoctoral positions in the Electron Paramagnetic Resonance Group at the National High Magnetic Field Laboratory

See also: www.magnet.fsu.edu and www.magnet.fsu.edu/usershub/scientificdivisions/emr/overview.html

The EPR group at the US National High Magnetic Field Laboratory (NHMFL) anticipates hiring two postdoctoral research associates starting in early/mid 2009. The EPR program is currently undergoing an expansion, including the appointment of a new di-

rector. The group comprises four permanent faculty-level in-house research scientists who develop high-field instrumentation, assist external users, and conduct their own programs of research. The group also supports several postdocs, graduate students, and visiting scientists. In addition to in-house research and outside collaboration, there is strong interaction with research groups in several departments at Florida State University and other universities in the region, in areas such as condensed matter physics, materials science, chemistry, and structural biology. The EPR program features unique high-frequency spectrometers (operating from X-band up to 900 GHz), and has access to a wide array of magnets suitable for EPR spectroscopy, including the world's highest static field of 45 T. Current research areas include: molecular magnetism, superconductivity, quantum information, metallo-proteins, spin-labeled proteins, and instrument development for high-frequency continuous-wave and time-domain EPR. Future opportunities include the planned development of a THz-Infrared free-electron laser source at the NHMFL.

Minimum qualifications include a PhD in Physics, Chemistry, Biology, or a related discipline. Experience in instrument design/development is desirable. To apply, please send your curriculum vitae, a cover letter describing your experience, and the names and contact information of three references to Professor Stephen Hill, EMR Director, National High Magnetic Field Laboratory, Florida State University, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310-2740, 850-644-0311, fax 850-644-8350; or email hill@phys.ufl.edu.

The National High Magnetic Field Laboratory is An Equal Opportunity/Access/Affirmative Action Employer.

Research Scientist position in the Electron Paramagnetic Resonance Group at the National High Magnetic Field Laboratory

See also: www.magnet.fsu.edu and www.magnet.fsu.edu/usershub/scientificdivisions/emr/overview.html

The EPR group at the US National High Magnetic Field Laboratory (NHMFL) anticipates hiring a permanent in-house scholar scientist starting in early/mid 2009. The EPR program is currently undergoing an expansion, including the appointment of a new director. The group presently comprises three faculty-level in-house scholar scientists who develop high-field instrumentation, assist external users, and conduct their own programs of research. In addition, the group supports several postdocs, FSU graduate students, and visiting scientists. The EPR program features unique high-frequency spectrometers (operating from X-band up to 900 GHz), and has access to a wide array of magnets suitable for EPR spectroscopy, including the world's highest static field of 45 T. Current research areas include: metallo-proteins, spin-labeled proteins, molecular magnetism, quantum information, and instrument development for high-frequency continuous-wave and time-domain EPR. Future opportunities include the planned development of a THz-Infrared free-electron laser source.

Minimum qualifications include a PhD in Biology, Chemistry, Physics, or a related discipline. Candidates should also have a strong track record of independent scientific scholarship in one or more of these areas. Experience in instrument design/development is desirable but not essential. To apply, please send your curriculum vitae, a cover letter describing your experience, and the names and contact information of three references to Professor Stephen Hill, EMR Director, National High Magnetic Field Laboratory, Florida State University, 1800 E. Paul Dirac Drive, Tallahassee, FL 32310-2740, 850-644-0311, fax 850-644-8350; or email hill@phys.ufl.edu. The National High Magnetic Field Laboratory is An Equal Opportunity/Access/Affirmative Action Employer.

EQUIPMENT

Design and construction of EPR electronics

The University of Denver can supply electronic design and construction services for EPR applications. Low-noise pulse amplifiers, low-noise 100 kHz preamplifiers, boxcar integrators, and pulse timing systems are available. We also supply a conversion kit to convert Varian field-control units to voltage-controlled scan operation. A 6-digit 1-ppm frequency counter is available in X-, C-, S-, L-band, or MHz versions. Complete microwave/RF bridges from 150 MHz to L-, S-, or C-band are available from designs previously built and tested at the University of Denver.

Please contact: Richard W. Quine, e-mail: rquine@du.edu, phone: 1-303-871-2419

Available: EPR accessories and supplies

We have some excess EPR accessories and supplies that might be of use to other labs. For example, we have a lot of chart paper, pens and ink for older recorders, and some spare parts and accessories such as VT Dewars for older spectrometers. If you need something for an older-style Varian or Bruker spectrometer, ask us – we might be able to help. Most items are available for shipping costs.

Gareth R. Eaton geaton@du.edu

For sale: Varian and ESR equipment

Resonance Instruments has available: (1) Replacement klystrons for Varian EPR bridges and some Bruker bridges (at reduced prices) and other klystrons; (2) Resonance Instrument's Model 8320A is a general purpose Hall-effect based magnetic field controller that provides direct control and precise regulation of the magnetic field between the pole pieces of an electromatnet. Its high resolution permits precise adjustment of the magnet's field either though the front panel keyboard or though an RS232 serial interface with your PC.

Please contact:
Clarence Arnow, President, e-mail: 8400sales@resonanceinstruments.com, phone: 1-847-583-1000, fax: 1-847-583-1021.

Available: Used Varian EPR equipment

(1) Varian E-104 EPR spectrometer with vertical style bridge and e-line fieldial. (2) Varian E-9 EPR spectrometer. Both available with warranty and continued service support. (3) Varian TM cavity with flat cell holders and flat cells. (4) Varian E-257 variable temperature controller with heater sensor and insert holder. (5) Varian E-272B field/frequency lock accessory.

Please contact: James Anderson, Research Specialties, 1030 S. Main St., Cedar Grove, WI 53013, USA.
phone/fax: 1-920-668-9905
e-mail: janderson36@wi.rr.com

Design, upgrade and repair of EPR equipment

St.Petersburg Instruments (Russia) has available: (1) Compact high performance X-band EPR Spectrometer. (2) Microwave X-band low-noise Gunn oscillators. (3) Small low-weight magnet systems based on electromagnets or permanent magnets. (4) PC control electronic units. (5) Specialized EPR software. **Please contact:** Valeri Drapkin, St. Petersburg Instruments, P.O.Box 123, St.-Petersburg, 194156, Russia.
phone/fax: +7-812-234-25-96
site: www.spinltd.ru
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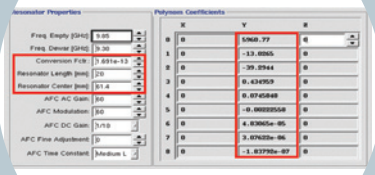

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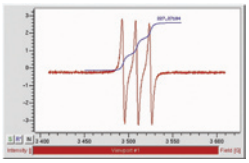

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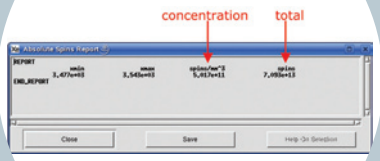

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