

epr news letter

2009
volume 19 number 3



The Publication of the International
EPR (ESR) Society



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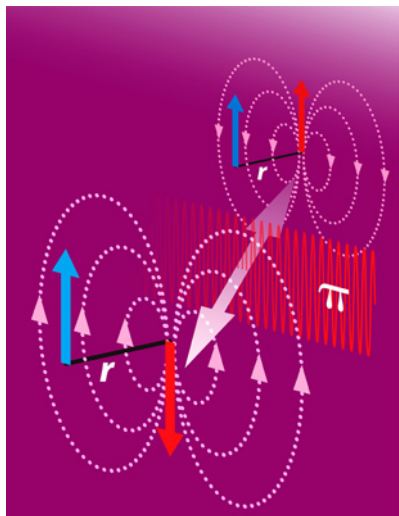
Please feel free to contact us with items (news, notices, technical notes, and comments) or ideas for the *EPR newsletter*.

The *EPR newsletter* is published quarterly by the International EPR (ESR) Society and is available in electronic and printed form to all members of the Society. The deadlines for submission of news for upcoming issues: Spring March, 15; Summer June, 15; Fall September, 15; Winter December, 15.

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The cover picture illustrates aspects of research carried out by Gunnar Jeschke, recipient of the Bruker award 2009. It shows the change in the local field at an observer spin (blue) caused by the flip of a pumped spin (red), which is in turn induced by a microwave π pulse. The ribbon model in the background symbolizes the structure of the dimer of sodium/proton antiporter NhaA of *E. coli* that was found from the known monomer structure by distance measurements that are based on this local field change.

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Editorial

Dear colleagues,

I can imagine that the copies of the 20th IES anniversary issue of the *EPR newsletter* 19/1-2 you have just found in your mail brought you a nice surprise: color in the center spread. It makes a big difference, doesn't it? I am in hurry to tell you who is to be thanked for it: our printer, LaPlume and Sons Printing prepared this section at no additional charge as recognition of Bruker BioSpin for their continued support and business. Thanks again, Scott!

To celebrate the 20th anniversary of the IES, after enjoying the academic environment of Oxford (UK) in 2007 and the exotic magic of Cairns (Australia) in 2008, the 2009 IES Annual meeting returned to the magnificent beauty of the Rocky Mountains at the

EPR Symposium in Snowmass, CO (p. 25). The minutes of the IES Annual meeting (p. 3) summarize the past 20 years of the IES and present its achievements and progress in encouraging numerous EPR developments worldwide in various fields of science.

Our "Another Passion" column once again shows that there are unknown depths in a human being and in the long run, who can say that we know somebody? It is amazing that working on the issues of the *EPR newsletter*, we get to know about the "other passions" of our colleagues and, as a result, we can share their non-EPR-related activities. This time Chris Rhodes tells of his experiences on the road to becoming a published novelist and poet (p. 9). Even a very short collection of his poems let you feel the vigor and pitch of his poetry. Chris, I agree that it will surprise a lot of people in EPR world, especially those who think they know you, but actually do not.

To continue with publishing stories about the EPR labs, we invite you to EPR at the Argonne National Laboratory (p. 16). John Weil (see also his article on tensors in magnetic resonance in 17/1, p. 1 and his laudatio in 19/1-2, p. 23) and Marion Thurnauer (who has read her article on flying in Alaska in 15/1, pp. 4-8 would be ever impressed by her talent of a story-teller) cover the development of EPR over half a century in the famous Argonne National Laboratory (USA). Like everybody, when visiting the ANL in 2008, I was greatly impressed by the high level of the EPR research performed at the Chemistry Division.

It is a special delight for me to turn now to the "Anniversaries" column. Our heartfelt congratulations to Giovanni Giacometti (p. 13) and Maksut Zaripov (p. 14) who celebrate their 80th birthdays, and to Wolfgang Lubitz (p. 15) on the occasion of his 60th birthday! I can confirm that the EPR students of Prof. Zaripov who took his course of the theory of EPR at the Kazan State University, are most grateful to him for his profound lectures. And you, who read our issues regularly, understand that we can never thank Wolfgang enough for his help and support with the *EPR newsletter* but, Wolfgang, we keep trying!

Who said that life is a sequence of white and black stripes? Yes, it is, and it is the black stripe that we publish an "In Memoriam" article for the late Jan Stankowski (p. 23). It is difficult to believe that our EPR community has lost an outstanding physicist, reliable colleague and dear friend.

This is my last editorial of 2009. Happy New Year to you, our dear readers! I wish you all the best! Our editorial team plans informative issues of the *EPR newsletter* in 2010, hopefully of interest to you, and in turn, we are looking forward to your input. It is a two-way street!

Laila Mosina

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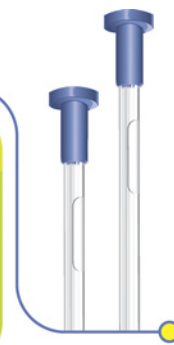
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Annual General Meeting 2009

Held at the 51st RMCAC Conference in Snowmass on 22 July 2009. The meeting was opened and chaired by Jack Freed, the President of the Society, and commenced at 17:00.

The agenda of the meeting and minutes of the annual general meeting (AGM) 2008 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).

1. Attendance and Apologies

Attendance (32): Katsuo Asakura, Andrei Astashkin, Dave Barr, S. V. Bhat, Garry Buettner, David Budil, Keith Earle, S. S. Eaton, G. R. Eaton, Boris Epel, Jack H. Freed, Wojciech Froncisz, Howard Halpern, Steve Hill, Matthew Krzyaniak, Saba Mattar, Daniel Mayo, Robert McCarrick, John McCracken, Glenn Millhauser, Sushil Misra, Yukio Mizuta, Reef Morse, Laila Mosina, Oleg Poluektov, Jessica Saner, Tatyana Smirnova, Alex I. Smirnov, Stefan Stoll, Takiji Takui, Wolfgang Trommer, Zhongyu Yang.

Apologies: The VP's Bowman and Davies sent their apologies for not being able to attend.

Mike Bowman would like to remind all American EPR researchers to renew their memberships for 2009, if not already done so, and non-members to become members of IES.

2. 2008 Minutes

The minutes of the General Meeting held on the 17th July 2008 were presented, and accepted unanimously as a true record of the previous meeting.

3. President's Report (presented by J. Freed)

Dear Colleagues,

On behalf of the IES Executive Committee, I wish to welcome all participants to the 2009 General Meeting of the IES and the 51st ARMCAC Conference in Snowmass. I would like to express my gratitude to the organizers of this meeting, especially Hassane Mchaourab, for allowing our General Meeting to take place during this Conference.

This General Meeting marks the 20th Anniversary of the IES, and thus a time to reflect on its achievements and activities. For this, it returns to the USA after the previous two meetings in Oxford (UK) and Cairns (Australia).

It is a particular pleasure for me to preside over the IES meeting this year – its 20th Anniversary.

Over these past 20 years the ESR/EPR field has witnessed a real renaissance. These include new instrumental & theoretical technologies which realize its potentials of:

- High Spin Sensitivity
 - Excellent Spectral Resolution
 - High Sensitivity to Molecular Motion
 - Ability to Measure Short & Long Distances Within & Between Molecules
 - Medical Imaging & Microscopy Down to Micron Dimensions
 - Limited Degree to which the Measurement Disrupts the Host
 - Availability of Spin Labels for a Wide Range of Applications
 - Convenience of Measurement
- Applications of these capabilities include:

Both chemical and biological applications including the study of free radicals, metalloenzymes and organo-metallic compounds, polymers, protein and membrane structure and dynamics, molecular dynamics in complex fluids, electron transfer reactions, and spin-trapping.

In the physics/materials field, new applications such as superparamagnetism, quantum dots, and quantum computing have emerged and add to studies of ferromagnetism, semi-conductors, and defect centers.

Surely, the audience will be able to add to this extensive list.

Over the last 20 years, the IES has provided encouragement to these and other EPR developments worldwide in all scientific fields and aided in the dissemination of new ideas and methods in EPR spectroscopy throughout the scientific community.

The IES will continue to actively support and participate in the numerous national and international conferences and workshops and encourage new. The IES will support established EPR groups and centers, to maintain, and to re-establish where needed, ties amongst these EPR activities in a true international spirit.

The IES will continue to foster its accessibility to its members, providing them with the latest information on the many activities in the field of EPR.

- Let us first honor the Past Presidents of the IES:

1989–1993 Hal Swartz (USA)
1993–1996 Keith McLauchlan (UK)
1996–1999 Jim Norris (USA)
1999–2002 John Pilbrow (Australia)
2002–2005 Yuri Tsvetkov (Russia)
2005–2008 Wolfgang Lubitz (Germany)

Annual General Meeting 2009

- Let us also honor the distinguished Awardees of the IES.

These awards were initiated in 1992 with the Gold Medal and extended in 1994 to include the Silver Medals in various specialized areas of EPR. They are Silver Medals in Chemistry, Biology/Medicine, Physics/Materials Science, Instrumentation, and the Young Investigator Award.

Gold Medal	2001 Balaraman Kalyanaraman	1996 Johann-Martin Spaeth	2007 No Award
1992 George Feher	2002 Ohara Augusto	1997 Roger Isaacson	2008 Hitoshi Ohta
1993 James Hyde	2003 Michael Davies	1998 William Mims	2009 No Award
1994 Jack Freed	2004 No Award	(Split into 2 medals after 1998)	Next: 2011
1995 Sam Weissman	2005 No Award		
1996 Kev Salikhov	2006 Periannan Kuppusamy & Jay Zweier	Silver Medal: Physics/Materials Science	Young Investigator Award
1997 Harden M. McConnell	2007 No award	1999 George Watkins	1994 Devkumar Mustafi
1998 Arthur Schweiger	2008 No award	2000 Klaus-Peter Dinse	1995 R. David Britt
1999 Brian M. Hoffman	2009 Award to Garry Buettner	2001 Gert Denninger	1996 Gunnar Jeschke
2000 Wayne L. Hubbell	Next: 2012	2002 CAJ (Rob) Ammerlaan	1997 Robert Bittl
2001 Klaus Möbius		2003 Edgar Groenen	1998 Alex Smirnov
2002 Keith McLauchlan		2004 No Award	1999 Ilya A. Shkrob
2003 No Award	Silver Medal: Chemistry	2005 No Award	2000 Bernard Gallez & Karsten M?der
2004 No Award	1994 Keith McLauchlan	2006 No Award	2001 Mark Newton
2005 Wolfgang Lubitz	1995 Clyde Hutchison	2007 Thomas Prisner	2002 Marina Bennati
2006 No Award	1996 Klaus M?bius	2008 No Award	2003 Stephan Zech
2007 No award	1997 Hanns Fischer	2009 No Award	2004 No Award
2008 Jan Schmidt	1998 Richard Fessenden	Next: 2010	2005 Eric McInnes
2009 No Award	1999 Yuri Tsvetkov		2006 No Award
Next: 2011	2000 Larry Kevan	Silver Medal: Instrumentation	2007 Leonid Kulik
	2001 Carlo Corvaja & Seigo Yamauchi	2000 Sankaran Subramanian	2008 No Award
Silver Medal: Biology/Medicine		2001 Tadeusz Walczak	2009 Stefan Stoll
1994 Harold Swartz		2002 George Rinard & Richard Quine	Next: 2011
1995 Lev Blumenfeld	Silver Medal: Physics/Materials Science	2003 No Award	
1996 Ron Mason	Silver Medal: Physics/Instrumentation	2004 No Award	
1997 Anatole Vanin	1994 Wojciech Froncisz	2005 Jos Disselhorst	
1998 Ed Janzen	1995 Jan Schmidt	2006 No Award	
1999 Jack Peisach			
2000 Lawrence J. Berliner			

- The selection of Fellows of the Society was initiated in 1995 for honoring distinguished senior scientists for their extensive contributions to EPR. They include:

1995 Anatole Abragam, Brebis Bleaney*, Clyde Hutchison*, Aleksandr Prokhorov*, Samuel Weissman*	2003 Daniel Kivelson*, Harry Kurreck
1996 George Feher, Erwin Hahn, Joan van der Waals	2004 None
1998 George Fraenkel*, Karl Hausser*, Yuri Molin, Charles Poole, Charles Slichter, John Weil, David Whiffen*	2005 Harvey Buckmaster, Keith McLauchlan, Harold M. Swartz, George Watkins
1999 Melvin Klein*, Martyn Symons*, Hans C. Wolf	2006 John Pilbrow
2000 Anders Ehrenberg, Noboru Hirota, August H. Maki*, Bruce R. McGarvey, Tengiz Sanadze	2007 Leslie (Les) Sutcliffe
2001 James R. Bolton	2008 Sandra Eaton, Gareth Eaton
2002 James S. Hyde	2009 None
	2010 To be nominated
	* deceased

I want to thank all the members of the Medal Committees for their excellent work for the Society and the former President Wolfgang Lubitz and Vice Presidents Balaraman Kalyanaraman, Shozo Tero-Kubota & Carlo Corvaja for their very much appreciated support and help!



Are you interested in becoming 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

- Meetings and Conferences in 2009 and 2010

July 19–23, 2009

51st Annual Rocky Mountain Conference on Analytical Chemistry. Snowmass, Colorado, USA.

info@rockychem.com, www.rockychem.com

August 9–14, 2009

11th International Symposium on Spin & Magnetic Field Effects in Chemistry. Brock University, St. Catharines, Ontario Canada.

scm2009@brocku.ca, www.brocku.ca/scm09

August 9–13, 2009

Molecular Imaging 2009: Routes to 3-Dimensional Imaging of Single Molecules. Kavli Institute, Cornell University, Ithaca, New York, USA.

www.research.cornell.edu/KIC/events/mrfm2009/

August 30 – September 3, 2009

10th International Conference on Magnetic Resonance Microscopy (ICMRM10). West Yellowstone, Montana, USA.

www.icrm10.montana.edu

September 2–4, 2009

2nd International Symposium on Dynamic Nuclear Polarization: Theory – Hardware – Applications – Radical. Goethe University, Frankfurt AM Main, K?nigstein, Germany.

www.bio-dnp.uni-frankfurt.de/dnpsymp

September 6–11, 2009

7th European Federation of EPR Groups Meeting & COST P15 Closing Meeting. Antwerp, Belgium.

www.efep2009.ua.ac.be

October 11–16, 2009

School on Dynamic Nuclear Polarization (DNP). Weizmann Institute, Safed, Israel.

www.weizmann.ac.il/conferences/DNP

November 6–8, 2009

38th Southeastern Magnetic Resonance Conference. Vanderbilt University, Nashville, Tennessee, USA.

semrc2009@vanderbilt.edu

November 8–9, 2009

International Workshop Electron Magnetic Resonance of Strongly Correlated Spin Systems (EMRSCS2009). Kobe University, Kobe, Japan.

extreme.phys.sci.kobe-u.ac.jp/EMRSCS2009

November 10–12, 2009

48th Annual Meeting of the Society of Electron Spin Science & Technology (SEST2009). Kobe University, Kobe, Japan.

extreme.phys.sci.kobe-u.ac.jp/EMRSCS2009

November 15–17, 2009

Workshop on Structure and Dynamics By Multifrequency ESR/ EPR. ACERT, Cornell University, Ithaca, New York, USA.

www.acert.cornell.edu

March 21–25, 2010

UK ESR Spectroscopy Group's Annual International Conference. Cardiff, UK.

www.esr-group.org.uk

May 2–6, 2010

EPR 2010: International Conference on Electron Paramagnetic Resonance Spectroscopy and Imaging of Biological Systems. San Juan, Puerto Rico.

antonio.alegria1@upr.edu, www.epr2010.org

July 4–9, 2010

Joint EUROMAR 2010 and 17th ISMAR Conference, (WWMR2010). Florence, Italy.

www.cerm.unifi.it/wwmr2010

December 15–20, 2010

Nitroxide Radicals: Synthesis and Advanced Bio- and Nano-materials Applications International Chemical Congress of Pacific Basin Societies (Pacifichem). Honolulu, Hawaii, USA.

www.pacifichem.org

This list can also be found at www.ieprs.org website.

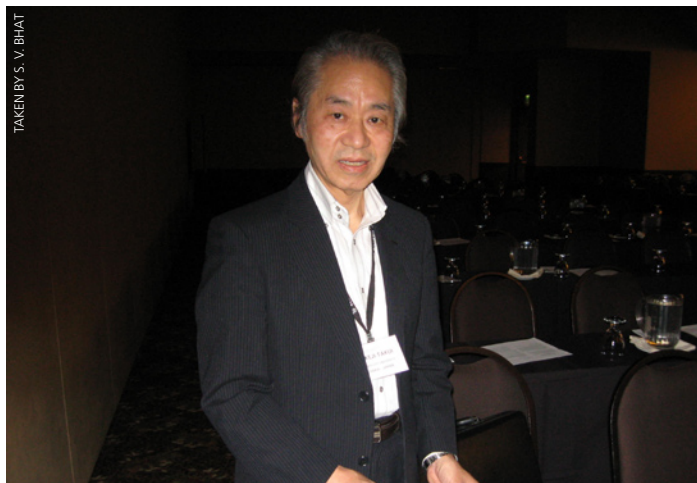
Please add to the list (send information to the IES Secretary and the Newsletter Editor Laila Mosina)

4. Secretary's Report (presented by S. Misra)

- IES Awards 2009

– Silver Medal (Chemistry):

Prof. Takeji Takui (Osaka University, Japan)



– Silver Medal (Biology/Medicine):

Prof. Garry Buettner (University of Iowa, USA)



- Young Investigator’s Award:
Stefan Stoll (University of California at Davis, USA)



All awards for 2009 were presented at the time the invited talks are given by the recipients during the RMCAC conference in Snowmass, CO, USA, July 19–23, 2009.

• **IES Awards 2010**

Nominations are invited for the following awards:

- Silver Medal for Physics/Materials
- Fellows of the Society

Visit IES web site www.ieprs.org for full constitution and by-laws.

Send nominations to the IES President.

Closing date: 15th November 2009.

• **IES Activities**

The Secretary is responsible for day-to-day operations of the Society, and ensures efficient functioning of the Society, e.g.

- Sending out invoices to the sponsors;
- Informing members of the various items of interest to them, e.g. announcements of conferences and workshops;
- Organization of awards given by the IES: certificates and citations;
- Overlooking financial status and membership of the Society;
- Web site (revamping, as done in 2009);
- Up-dating IES letterhead;
- Answering any enquiries;
- Organizing the AGM;
- Liaison with the Editor of the EPR newsletter.

• **IES Executive Elections 2008**

Starting October 1, 2008 the following Executive, elected by acclamation, serve the IES for the period 2008–11:

- 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)
- Newsletter Editor: Laila Mosina (Russian Federation)

I sincerely thank Shirley Fairhurst, my predecessor, for her enthusiastic cooperation on all matters of secretarial advice whenever required by me.

IES web site (www.ieprs.org): A series of screen shots was shown (see Newsletter article on using the IES web site 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.

5. Treasurer’s Report (presented by T. Smirnova)

- **Commenst from the Treasurer:**
 - In 2008 sponsor’s contributions were collected on time and income from membership fees increased by \$200 compared with the 2007 level.
 - We have a relatively secure financial position and in 2008 we have maintained a balanced budget. We have preserved the financial buffer of almost a year of funding in the “bank”.
 - We need members to pay their dues on time and to increase our membership levels.
- **Comments from the Treasurer:**
 - In 2009 we project higher expenditures due to the cost of updating the web site

2008 Financial Report (\$) (unaudited)

Balance January 1, 2008	10,747.40
Income:	
Membership	4,745.01
Sponsors	5,345.00
Total Income	10,090.01
Expenses:	
Bank & credit card fees	833.42
Web design & fees	213.90
Newsletter	9,197.00
Awards	150.00
State of Illinois	13.00
RMCAC	500.00
Total Expences	10,907.32
Balance December 31, 2008	9,930.09

2009 (January-June) Financial Report (\$)

Balance January 1, 2009	9,930.09
Income:	
Membership	1,945.56
Sponsors	1,840.00
Total Income	3,785.56
Expenses:	
Bank & credit card fees	412.96
Web design & fees	56.25
Newsletter	4,137.00
Awards	150.00
State of Illinois	13.00
Total Expences	4,769.21
Balance June 30, 2009	8,937.44

Obligations for 2009 5,221.90

and an increased level of sponsorship of RMCAC

- We more than ever need support of the members and our sponsors.

Membership fees are unchanged at:

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

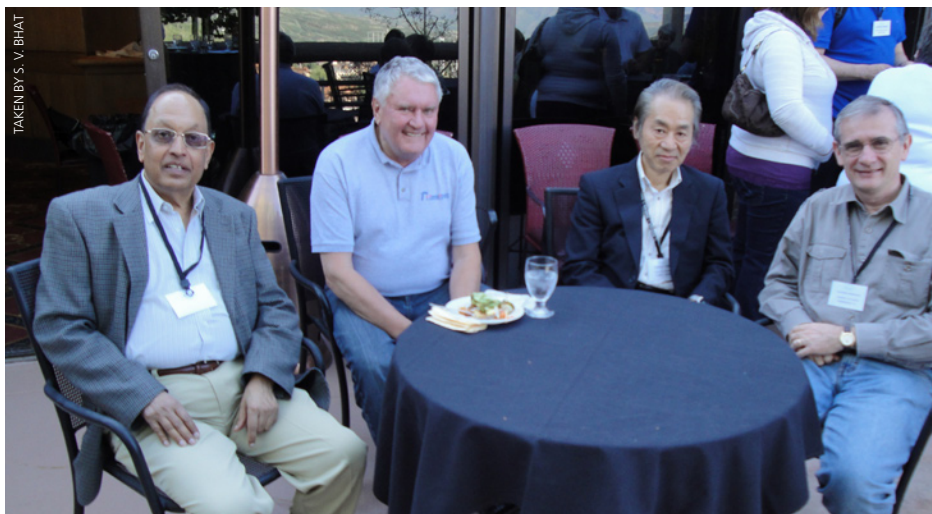
Membership forms are included in the handouts or join via the web site:

www.ieprs.org.

• **Note from the Treasurer:**

In the past dues were collected by Regional Treasurers. This situation ceased when credit card payment on our secure web site 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 web site and by the member contacting the Treasurer.

From left to right: S. K. Misra, W. Trommer, T. Takui, A. Angerhofer



6. Newsletter Editor's Report (presented by Laila Mosina)

Since the previous Annual Meeting of the IES in 2008 in Cairns we published two single issues, 18/1 and 18/4, and a double issue 18/2-3. We hope all of you had a look at them on the newsletter web site and got copies as well.

A preview of the latest issue 19/1-2, a public double issue dedicated to the 20th anniversary of the IES, was presented. By now (September 09) it is already on the newsletter web site 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: John Pilbrow, Candice Klug, Thomas Prisner, Stefan Stoll, Keith Earle and David Budil, and also to Fabienne Ruffieux, Besnik Kasumaj and Yevhen Polynach, our web-masters, and Sergei Akhmin, our Technical Editor. I highly estimate Shirley Fairhurst's continuing support of the EPR newsletter.

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 2008-2009:

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 Associate Editors: Thomas Prisner, Candice Klug and Hitoshi Ohta

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

8. Other business

W. Trommer thanked the Executive of IES for the organizing the AGM and the reception.

All participants of the meeting were invited to a reception hosted jointly by the IES and the organizers of RMCAC to honor the recipients of the IES awards.

The meeting was adjourned at 17:45.



Awards

The Bruker Prize 2009 to Gunnar Jeschke

From left to right: David Collison (ESR Group Chair), Roger Ladbury (Bruker BioSpin), Gunnar Jeschke (2009 Bruker Prize), Christiane Timmel (Oxford).

*For details,
see this newsletter, p. 24*





Angelika Boeer:

I am very honoured to have received the JEOL student prize at this year's Annual Meeting of the RSC Electron Spin Resonance Spectroscopy Group in Norwich (April, 2009). The medal is a wonderful way of rounding off three years of research within the communities of molecular magnetism and paramagnetic resonance spectroscopy. After my Chemistry degree at the Johannes Gutenberg University of Mainz (Germany), I moved to The University of Manchester (UK) in 2006 to carry out a Ph.D. within the research group of Professor David Collison and Professor Richard E. P. Winpenny on "Anisotropy in Molecular Magnetism – Magnetic Exchange Coupling of Octahedral Cobalt(II) Ions".

In the past two decades, many different kinds of molecular nanomagnets have been studied intensively and they are still of growing interest towards the development of molecular-magnetic storage devices, magnetic refrigeration, and quantum information processing. In contrast to conventional bulk magnetism, magnetic properties are based on intramolecular exchange interactions between spin centres of isolated molecular cluster arrangements, which open up a whole new and exciting field of quantum-physical phenomena. A particularly important property related to molecular magnetism that is still not sufficiently understood is magnetic anisotropy, which occurs, for example, in magnetic ions that contain an unquenched orbital angular momentum. Many such compounds are known, but very little is understood about their magnetic exchange coupling because of theoretical complications arising from first-order spin-orbit coupling. My research has focused on the magnetic and spectroscopic properties of very anisotropic exchange-coupled octahedral cobalt(II) coordination compounds. The key towards a better understanding of magnetic anisotropy lays in the use of complementary measurement techniques, in my case multifrequency EPR spectroscopy, superconducting quantum interference device (SQUID) magnetometry, inelastic neutron scattering (INS), and magnetic circular dichroism (MCD) spectroscopy, and in particular in measurements on single crystals,

which have provided direct access to molecular anisotropies.

During this multidisciplinary project, I was fortunate to work and to collaborate with many excellent scientists all over Europe. Several conferences including the Annual Meetings of the RSC ESR Spectroscopy Group have given me the opportunity to present and to discuss my research and to build important collaborations. I have thoroughly enjoyed those meetings, where I met many wonderful people (and I will never forget the excited face and encouraging nods of Professor Gunnar Jeschke during my JEOL lecture!).

Aside from research, communication of science has always been a passion of mine. This covers both the public science sector – translating research language into a graphic story for the general public without the loss of scientific accuracy is both challenging and exciting – as well as the importance of high quality communication of excellent science. In 2008 I was invited to contribute to a book chapter on *EPR of Exchange Coupled Oligomers* within the RSC review series *Specialist Periodical Reports – Electron Paramagnetic Resonance* (Eds. B. C. Gilbert, M. J. Davies, D. M. Murphy).

Having completed my doctorate, I have recently started a career in scientific publishing, which combines my desire to communicate science with close contact to fundamental and novel research.



The JEOL Student Talk Prize to Angelika Boeer

From left to right: Angelika Boeer, Bela Bode and Susanne Pudollek.

For details, see this newsletter, p. 24

Poetry and Novel Writing

Christopher James Rhodes*

I wrote obituaries for Bryn Mile and Brian Webster which were published in the *EPR newsletter* and the Royal Society of Chemistry's publication, *Chemistry World*. Naturally, this is never a job I enjoy doing, especially about people I am fond of, as I was of both Bryn and Brian. Probably to relieve my tension a little, I remarked to Laila Mosina that when my time came, I hoped someone would also mention that I am a published novelist and poet, which prompted her to invite me to write a piece about this "other passion" of mine. Writing is indeed a passion, and I fell in love with the written word when I was 18, on moving into a pretty squalid single-room to live, but all I could afford at the time, which did have as its redeeming feature an abandoned volume of poetry, leather-bound with its pages embossed on their edges with gold-leaf, written by Sir Walter Scott. I was particularly impressed by *The Lady of the Lake*, and *The Bridal of Triermain*, and I learned the latter poem by heart. This was not a good time of my life, and the rhythm, words and cadence of Scott's poetry afforded some consolation to an otherwise rather miserable period of isolation.

Scott is to my contemporary taste a little on the dry and heavy side. He is what many would call an "epic poet", telling long-winded stories of valour and intrepidity. *The Lady of the Lake* is based on the legend of King Arthur (it was the lady who handed Arthur the sword called *Excalibur* by the poet Tennyson but *Caliburn* by Scott, reaching out to him from beneath the waters), but worked

into a Scottish legend, which gives you some idea of Scott's style; he was nonetheless a gifted wordsmith, without question. The name *Excalibur* derives from Old French *Excalibor*, which came from *Caliburn* used in Geoffrey of Monmouth (Latin *Caliburnus*); in Welsh, the sword is called Caledfwlch.

As my romantic side began to emerge, I found tremendous human power in W. H. Auden, reckoned by many as the greatest English poet of the 20th century, my having fallen in love with a girl, whom I later married, who bought me an anthology of poems, in which was *Lullaby*, also known most often by its first line, "*Lay Your Sleeping Head*".

"Lay your sleeping head, my love,
Human on my faithless arm;
Time and fevers burn away
Individual beauty from
Thoughtful children, and the grave
Proves the child ephemeral:
But in my arms till break of day
Let the living creature lie,
Mortal, guilty, but to me
The entirely beautiful."

If Auden is the greatest English poet of the 20th Century then it seems fair to confer a similar accolade upon Dylan Thomas as the greatest Welsh poet of that same period of history. I am Welsh in fact, having been born in Cardiff and when I read Dylan's poetry, I can hear the Welsh accents from my childhood, all the more so when I read one of his plays, particularly *Under Milk Wood*. As I become older I realise there is more Welsh in me than I ever gave credit for, but that is only in the spirit of coming-home that people often find as they approach middle age. Probably Dylan Thomas' most renowned poem is the villanelle, "*Do not go gentle into that good night*" written about his dying father, in which he implores the old



man on his deathbed to not just slip quietly out of this life but to "rage, rage against the dying of the light"; because "old age should burn and rave at close of day." As friends and close relatives have passed-on over the years, this poem becomes more poignant for me, as does *Lay Your Sleeping Head*, as measured against the backdrop of experience of love, loss and all other packets of emotions that prevail upon each of us. The ironical force of the alternative title, *Lullaby*, is expressed by the fact that the speaker keeps vigil on a fragile and unequal love that fades as dripping-sand and he can only watch it die, unable to communicate with his lover who remains asleep and thus silent throughout this soliloquy. My own poetry writing took-on its embryonic form when I was 18, inspired by Scott, and most of it written then has long since been thrown away, or with more ecological soundness put into the recycling-bin. I used poetry as a mirror for my life and as a sounding-board to understand the rising of my emotions for the next couple of years and then stopped, aged about 20, when I went to university to study chemistry. I didn't write another line until about 5 years ago (25 years later), when I joined an on-line poetry site. This coincided with my formally leaving university life to set-up my own consulting business, *Fresh-lands Environmental Actions* and I had already decided that I wanted to try my hand at novel-writing too.

* Professor Chris Rhodes has a visiting position at the University of Reading and is Director of Freshlands Environmental Actions (PO Box 2074, Reading RG4 5ZQ, U.K. e-mail: cjrhodes@fresh-lands.com). He was awarded a D.Phil from the University of Sussex in 1985 and a D.Sc in 2003. He has catholic scientific interests (www.fresh-lands.com) which cover radiation chemistry, catalysis, zeolites, radioisotopes, free radicals and electron spin resonance spectroscopy, and more recently have developed into aspects of environmental decontamination and the sustainable production of energy and fuels. He has published more than 200 peer-reviewed articles and 5 books, and is also a published novelist, journalist and poet.

I made some friends and fans on the various poetry sites that I have belonged to, and a nice lady, and fellow poet, in South Africa called Vivienne Harding recommended me for a poetry prize, with the consequence that I received a merit-based scholarship from the American, *Cole Foundation for the Arts*, to publish a collection of 45 of my poems, entitled *Fresh-lands*, as a metaphor for the process of moving-on that was occurring in my life. Mostly I write in free-verse, which is how the words and emotions come to me, but there are some structured poems too... sonnets and villanelles and some other forms I have tried (including traditional Welsh verse styles, such as Clogymach, Cyhydd Hir, Cyrch a Chwta, Cywydd Devair Fyrion and Englyn Penfyr) but mostly for me it is free-verse, which is both a style and no style. I feel that poetry, when it works, is the energy that lies under the words, almost like a sense of love, or some other feeling. The emotions and words come thick and fast and I need to condense them from the mist before they evaporate. So this is the style I choose. I have written a collection of about 300 poems all-told.

Starting-up a business is a tough term, and so I decided to write my first novel as a distraction from those times when I was waiting for people to get back to me, or otherwise progress seemed to be in the doldrums. I managed to complete this work, called *University Shambles* (www.university-shambles.com) after a period of 18 months. Writing is not easy either, but such things are relative and it is easy in comparison with the effort of finding a publisher, which took a further 3 years, and much despair. Most people don't take rejection well, and I think I may be particularly sensitive in this regard, probably because of my upbringing in which I had to endure much of this, in a complex family of complicated people all emotionally stifled by their own issues and provenances. Accordingly, I found the thickening mound of rejection slips from literary agents entirely dispiriting, and I left the manuscript on my desk, facing me mournfully for another twelve months. I was on the verge of giving-up and I had decided to use an on-line publishing service to do the job of publication, and then do my best to undertake the promotion and marketing myself. On the advice of a friend (a chemist



actually, but whose wife is an aspiring writer), I then decided to approach the matter of publication as a business venture and I wrote to 40 different publishers in one fell-swoop, deciding to “go-for-broke” as it were. Some of them wrote back and advised me get an agent; others didn't reply; others wrote back with exasperating phrases like “the work seems too retro for a modern readership” (whatever that may mean), or it was a standard rejection slip that gave me the impression that no-one had in fact bothered to read my masterpiece! It is odd to receive a letter addressed, “Dear Chris Rhodes”; why not “Dear Chris”, “Dear Mr Rhodes” or “Dear Professor Rhodes” even, as I had included my writing CV among the submission package? Out of that set of 40, I received two letters from publishers asking if they could read the entire manuscript, both of whom offered me a publishing deal. I decided to go with Melrose Books, who are based at Ely, near Cambridge, and they published *University Shambles* on April 6th, 2009. I remember trying to break-in to academic life (i.e. get a permanent academic post) and my feeling is that the world of publishing is rather similar: i.e. if you don't have the contacts you need to bang on an awful lot of doors on your own. In the former respect I finally managed to get a lectureship at Queen Mary College, London University, one of many British chemistry departments that have since been closed in the rationalisation of

expensive subjects such as science. However, once you are “in” and you produce reasonable work, then there are good possibilities for future success as an academic or as a writer or both, as I have become. The British university system has changed immeasurably during the past couple of decades and *University Shambles*, while a complete work of fiction, does illustrate some

of those more profound changes for example the relabeling of the former polytechnics as universities, which they are not and were never intended to be; the designation of students as customers, and the subsuming of “universities” into the hands of managers (men and women in *suits*) rather than academics. Malcolm Bradbury wrote *The History Man* in 1973, in a fictional commentary on the “new” universities of his time, and in a way *University Shambles* takes up the slack from the many changes that have threaded-on from then, but in a form that might be regarded as a satire or a black comedy, depending on your point of view. It centres around Charles Rae (a pun on the RAE, Research Assessment Exercise) an ambitious young lecturer at a lower mid-ranking university, whose head of department refuses to promote him on grounds of his youth. His ambition outweighs his patience, and he is seduced into accepting a professorship at the newly concocted and mendaciously named Evergreen Epstein University (EEU), formerly the Evergreen Polytechnic. The upshot is that Rae finds himself in a nightmare world that seems to have been deliberately engineered to destroy him. He discovers that none of the other “professors” at EEU actually have any published work, which renders his own position worthless from the outset. Realising that he is the victim both of EEU's deception and his own rabid ambition, he finally goes insane unable to tolerate the overwhelming sense of burdensome futility and contempt for the academic standards he holds dear. I hope that anyone working in or familiar with universities will enjoy this book, but its message of “be careful what you wish for” and “those whom the gods wish to destroy they first grant their wishes” applies equally to all ill-managed corporate organisations. I stress it is a comedy and I hope that it reinforces that I do have a sense of humour, for those who don't know me, and that I am a real human being, not a science-robot, as media prejudice would have us all to be in

The Miners

In that intention a cloud was forged,
emerging from thickest bracken,
like lovers sharing a shy glance
of mingled nudges.

Rising high on the tall hills,
which knew our adolescence,
and where

we lay
among filtered sunbeams,
on a shelf of ochred promises,
casting back strewn dreams
and lullubys for children
never born.

Clamorous amid grey slates
of rain,
the crow coughs its
guilty secrets of ascending glory;
wings flashing spangled black,
like the dust on miners'
faces,

as they rise from the seam.
The wheel spins no more,
set solid in the past
tense of Wales,
but the cable will not break
from the muted winding-engine;
turning its face in a
shame of redundant expectation,
and its coal lies still,
under the foot of Monmouth,
waiting for the oil to run-out,
and still the world.

Welsh Lullaby

They are waiting for me,
the hills and green vales;
to take my place in the
calm womb of Wales,
when that day must come.
Monmouth rested his cheek
against the grey slate, quarrying
the coal-black silhouettes of
match-men; sketching each
generation between chapel and hill,
pit and choir.

Four children, warmed
by the chilblain fire,

igniting Monmouth's foot -
watching its untrampled spirits rise.
Bearing in heartland and hearth,
a love of born-earth
that reaches suddenly,
lending an odd, acute sense
of belonging - long lost.

From pit to farm, abandoned lambs
I nursed as a child;
taught to be tender; to warm life on;
to smoulder and grow,
and raising flame in these hands,
I now know,
I hew my own path.
Among such rocky passages
I am renewed and bound
to yield this borrowed stone;
to become one with that land again.

First Kiss

Memories are hazy;
blurred and blunted amid the
maze of my confounding history.
My first kiss?
Was it Rosemary when we were five:
"You show me yours,
I'll show you mine?"
Or my first girlfriend, Claire at ten?
We held our mouths open
but no tongues... not then.
Tongues slithered-in at around thirteen -
slippery, uncontrollable things -
and stayed that way
for much of my teens.
Then, finding real love
when I was about twenty -
that kiss I do remember,
because my life began then.

Cold War

We imagined it over:
solid concrete walls
and political screens of iron.
Partitioned nations and peoples
crushed by a polished, heavy stomp.
In Budapest they kept
the mighty bronze icons,
cast molten into the surly

face of Hungary,
unmanning even murmured
postures of insurrection.
The Berlin Wall was built
to keep them out not us in,
so shone the brilliance
of a regime that crumbled.
The Czechs were broken from
all sides, first sewn-in
with Slovakia (lands later amputated);
murdered by Heydrich's memory -
though they did get rid of him,
in a bitter snatch of triumph,
fleeting as a fly.

The boot trundled back to kick
them into touch in '68,
breaking poor mild Dubcek's heart.
One boy set himself on fire:
a torch that yet beckons
to the mindset of Prague;
among those vestiges of history
that are unforgettable,
but at least not yet forgotten.
From the rubble of *Der Berliner Mauer*
we saw the cold-war end.
Each of us holds a piece of
its stone, within us somewhere,
like relic wood from the cross;
making a million tonnes or so,
if its provenance should be believed.

Sundials

The dawn opened on a decadent world.
I opened slightly hazy eyes to see:
sling-backs tossed
separately into corners;
a couple of empty bottles
of champagne - one standing,
the other on its side.
I looked at you - still asleep and quiet -
and watched the Sun reach in,
to touch your hair;
igniting it into a copper flare,
then pass its shadow on,
over the cast-off party dress;
the scattered underwear.
Passing segments of a sundial,
marking time upon its face.

this line of business. Those who do know
me probably are already well aware of such
aspects of my character.

Book number two is of entirely differ-
ent nature. It is called "*Growing Our Way
to Hope*," which unintentionally makes the
apposite acronym, GrOWTH. This really
devolves, at least in subject matter, from a

blog that I write called "*Energy Balance*":
<http://ergobalance.blogspot.com>, my first
attempt at journalism, the readership of
which has grown into the thousands a day
since its inception in December 2005. I also
write a regular monthly column at [http://
scitizen.com](http://scitizen.com), which is an on-line magazine
something in the style of "New Scientist", on

Future Energies. I finished writing the first
novel in July 2005 and then in the Septem-
ber of that year I was invited to a meeting
at the Royal Geological Society in London
entitled, "Providing Energy for Britain to
2050", the conclusions from which were
later considered by a governmental commit-
tee and finally delivered at the Royal Society

later in that November. Now this was a bit of a turning point for me, in that it began to propagate some seeds that were sown into my psyche a couple of years before that, at another meeting aimed to celebrate its 30th anniversary, but also to evaluate the veracity of the predictions of E. F. Schumacher in his bestselling novel, "*Small is Beautiful*", with the strap-line, "a study of economics as if people mattered." It had occurred to me that the present system of expanding globalisation is unsustainable, and that it will be necessary to reverse the trend, re-localising society so that, for one thing, we are far less dependent on imported crude oil. Most forms of alternative energy fail "*The Scale Test*." For example, if we were to try and substitute petroleum based fuel by biofuels, e.g. from rapeseed oil, even if the entirety of the arable land in the U.K. was turned-over to fuel-crop production, we could produce a mere 10% equivalent of the 60 million tonnes of crude oil currently used to fuel all transport in the country. Hence, alternative schemes such as making biodiesel from algae should be exploited which is far more generously yielding, by perhaps a fac-

tor of a hundred. By reducing the amount of energy we use in total, principally in curbing personalised transport in the order of 90% of its current capacity, growing algae and other forms of biomass, including sea-based microalgae production, we have the basis of a sustainable society. This is the theme of GrOWTH. I realise that while Schumacher's ideas were mainly aimed at developing countries, they apply equally to an industrialised society that has necessarily de-globalised itself and is learning to get by with far less in the way of energy and other resources, and to do so without an inexorable consumption of limited and depleting reserves of fossil-fuels and uranium.

One final writing project is a series of children's stories, beginning with *Hippy the Happy Hippopotamus*. This is aimed to get ideas such as global warming, climate change, the damming of rivers, pollution, flooding and other sources of environmental impact over to kids. I first wrote them for my niece, but now she is 14, her interests have shifted somewhat, in the overwhelming grip of teenage hormones. The events in these stories are presented as seen through Hippy's eyes, who

is a young hippo with the psyche of a five year old boy, growing-up with his family in Africa, and how they affect his world. This is part of a far more extensive project aimed to promote a number of environmental protection areas. I am looking for a publisher for these, and in one of those strange chains of connections within the human matrix, an accomplished artist, Jeanette Cole, and a friend of a friend who coincidentally got in touch with me only recently after more than 10 years, has drawn some beautiful illustrations that depict remarkably how I saw the scenes in my mind's eye when I was writing the words for the "Hippy" series.

Writing is a passion for me. It is a wonderful form of self-expression, as all kinds of art are. When life is good, it enables the applause of those positive things and when the converse transpires from the shade of optimism, somehow writing, especially poetry has the effect of taking the sting out of unpleasant emotions. I have other novels planned, both factual and fictional, based around the human experience which having reached the age of 50 I am not inexperienced in. ●

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80th Birthday of Giovanni Giacometti

On September 6, 2009 Giovanni Giacometti celebrated his 80th birthday in Antwerp, where he and his wife Anna attended the 7th Conference of the European Federation of EPR Groups (EFEPR). In 1991 the first conference of this series took place in Padua (Italy), and it was Giovanni – working in the field of EPR for many decades – who was instrumental in planning and organizing this memorable conference, which marked the foundation of this non-formal organization of EPR groups from all over Europe (and somewhat beyond). Thus, the meeting of the EFEPR in Antwerp was very appropriate to congratulate him and to celebrate his birthday.

Giovanni Giacometti was born and spent his childhood in Genova. Later he moved to Venice, where he visited elementary and high school and received a very good and wide-ranging education. Based on his strong interest in the natural sciences he decided to study chemistry and physics, and he graduated (Laurea in Chemistry) already in 1951 from the University of Padua. After doing graduate work for some time in the laboratories of Linus Pauling in Pasadena (CA, USA) and Robert Mulliken in Chicago he became Assistant Professor in Padua in 1954 and scored a “Libera Docenza” in Physical Chemistry (equivalent to PhD) a year later.

Two years later he met Anna, married her and together they moved to the “New World”, this time to Ottawa (Canada), where Giovanni continued his work as a young researcher at the National Research Council. Anna and Giovanni have three daughters, Barbara, Marina and Giovanna, born in 1959, 1960 and 1969.

Since about 1960 Giovanni worked in Padua, where he became Professor and head of the Department of Theoretical and Physical Chemistry, only interrupted by his election as Visiting Scholar and Professor at the University of Glasgow (UK) in 1964 and Illinois Institute of Technology, Chicago, in 1967. For 30 years, from 1970 to 2000, he directed the Center of Radical and Excited Molecular States of the Italian National Research Council, and since 1976 he served as Dean of the Faculty of Sciences of the University of Padua for five years. From 1991 to 1997 he was first member of the Steering Committee, then of the Executive Committee of the ESF Program “Biophysics of Photosynthesis” of the European Science Foundation. Giovanni has



been a true leading figure in Physical Chemistry in Italy and beyond, he was President of the Chemical Physics Division of the Italian Chemical Society, and was elected as a member of the “Accademia Nazionale dei Lincei” in Rome, the Venetian Academy “Istituto Veneto di Scienze, Lettere ed Arti”, and foreign member of the “Société Royale des Sciences de Liège”. He received many awards, among them the “Bologna” Prize for Chemistry in 1963, the Gold Medal for Science and Arts of the Italian Republic in 1970 and the G. B. Bonino Gold Medal from the Italian Chemical Society in 2001. In 2006 he became an Honorary Professor of the University of Sichuan, Chengdu (China). He has been on the editorial boards of many scientific journals and published over 200 peer-reviewed articles, he is coauthor of two books.

Giovanni’s research interests are widespread; he started in theoretical chemistry, then worked on kinetic problems – especially on radical reactions using EPR – and later moved to biophysical and mechanistic studies of photosynthesis. His group cooperated actively with a number of European and US partners in the application of physical techniques, in particular EPR and ODMR, and contributed substantially to the understanding of the structure-function relationship of photosynthetic systems. This was achieved by close cooperation with Giovanni’s younger brother Giorgio who is leading a very active biochemical laboratory in Padua. A nice article telling the story of the two Giacometti brothers involved in photosynthesis

appeared recently in the journal *Photosynthesis Research* (2006).

Giovanni has many further interests and activities beyond science. He likes to read and to discuss not only poetry and novels in various languages, Italian, German, English, but also history and politics! Already in the early 1950’s – when he lived in the USA – he was shocked by the post-world war political situation, especially the McCarthy era. Back in Italy he joined – and also initiated – discussion groups not only with natural scientists but also with artists, politicians and other intellectuals. His engagement in the peace movement brought him to the Pugwash Organization – which is based on a manifest of Bertrand Russell and Albert Einstein in 1955 and named after a small town in Canada, where the first conference took place in 1957. He and his wife were strongly involved in the 14th Pugwash Conference in Venice in 1965. The social engagement of the Giacometti family – e.g. for problems of the 3rd world – is probably best expressed by their work for Somalia, a country they visited twice to work in higher education for 6 months. His brother and other colleagues from Rome were also involved in this work by setting up biochemical laboratories for clinical analysis in Somalia.

Since 2003 Giovanni Giacometti is Professor emeritus, but many of his scientific and personal activities still continue. A number of excellent Italian scientists originate from Giovanni’s laboratory in Padua, Pier Luigi Nordio, Carlo Corvaja, Marina Brustolon, Ulderico Segre – to name just a few. Among the younger scientists are Marilena Di Valentin, who was at the conference in Antwerp to present some of the photosynthesis work that started with Giovanni, and Donatella Carbonera, who received an associate professor’s position for biochemistry at Padua University already in 2000.

Giovanni, at the occasion of your 80th birthday we want to thank you for all that you have done particularly for the EPR community in Italy, Europe and worldwide. We know that currently Italy is not an easy place for science – and we wish you and your successors all the best for the future.

For your personal life we wish you good health, happiness with your wife and family, and a continuing interest in the sciences and your many other activities – and last but not least many happy returns of your birthday!

Wolfgang Lubitz

80th Birthday of Maksut M. Zaripov



Maksut M. Zaripov, a known physicist, scientist, teacher, eminent organizer of science, and recognized expert in the field of EPR in crystals, was born on September 8th, 1929. A graduate of the Physical-Mathematical Faculty of the Kazan State University in 1952, he defended his PhD thesis “To the Theory of Fine and Hyperfine Structures of Paramagnetic Resonance” in 1955 with Professor S. A. Al’tshuler as his mentor. In this dissertation, the foundations of the theory of magnetic resonance in a special class of substances which were subsequently called Van Vleck paramagnets were laid down. In the following years, these substances were studied in detail at the Kazan

University and a number of other scientific centers revealing a lot of their features and possibilities of their practical use. For this research, M. M. Zaripov and a group of his colleagues were awarded the State Premium of the Republic of Tatarstan in 2006.

The beginning of the independent scientific activity of M. M. Zaripov coincided with the period of the establishment of the Kazan school of magnetic resonance founded by the academician E. K. Zavoisky and Professors S. A. Al’tshuler and B. M. Kozyrev. M. M. Zaripov participated actively in this process. He headed a group of the physicists-experimenters who began regular research of EPR spectra of crystals, including those of the mineral origin, containing paramagnetic iron-group ions. As a result, the general regularities of the interaction of a paramagnetic ion with a crystal lattice were established and also the methods of magnetic resonance were widely introduced in crystallochemistry and geochemistry. Further, a series of the investigated crystals were applied as the working substances for quantum generators and amplifiers. In particular, the first observation and interpretation of the fine structure of the EPR spectrum of chromium ions in ruby (1956), a crystal being the basis of the first lasers created, is notable.

In 1963, M. M. Zaripov headed the newly created Chair of Quantum Electronics and Radiospectroscopy at the Kazan State University. For more than 40 years he gave a key course of lectures “Bases of the Theory of EPR Spectra”. In 2009, the Publishing House of the Kazan University printed M. M. Zaripov’s book containing the above course of lectures for undergraduates and postgraduates studying solid-state EPR.

In 1966, he defended his Dr.Sci. thesis “Study of the EPR Spectra of Crystals”. In the period from 1968 to 1971, he was the Dean of the Faculty of Physics of the Kazan State University, and in 1971, continuing lecturing at the University, he became the head of the Laboratory of Solid-State Physics in the Kazan Physical-Technical Institute (KPhTI) of the Kazan Branch of the Academy of Sciences of the USSR. From 1972 to 1988, M. M. Zaripov was the Director of the KPhTI as well as the Chairman of the Presidium of the Kazan Branch of the Academy of Sciences of the USSR in the period from 1972 to 1982.

In collaboration with his colleagues from the laboratory he headed, M. M. Zaripov discovered the recrystallization effect in the surface layer of an implanted semiconductor under the action of powerful laser irradiation (“laser annealing”, 1973), nowadays used in the technology of manufacturing semiconductor devices. For this research, in 1988 he and his collaborators were awarded the State Award of the USSR in the field of Science and Techniques.

Up to now, the scientific activity of M. M. Zaripov has resulted in more than two hundred papers, and 31 of his pupils have defended PhD theses. In addition, he was a mentor to eleven doctors of sciences. At present, M. M. Zaripov is a principal scientific researcher in the Laboratory of Radiospectroscopy of Dielectrics of the KPhTI and a Professor in the Chair of Quantum Electronics and Radiospectroscopy of the Kazan State University. M. M. Zaripov has been a corresponding member of the Academy of Sciences of the Republic of Tatarstan since 1992 and participates actively in its activities as a member of the Scientific Council of the Academy of Sciences of the Republic of Tatarstan on Physics. Professor M. M. Zaripov has been awarded several State Awards, including the Order of the Red Banner of Labor.

Our heartfelt congratulations to Maksut Mukhamedzyanovich Zaripov. We wish him good health and new creative achievements.

Linar K. Aminov
Murat S. Tagirov
Kev M. Salikhov

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60th Birthday of Wolfgang Lubitz

When Laila Mosina asked me to write an article about my former six-year supervisor Wolfgang Lubitz, I was honored. Professor Lubitz is well known in the EPR society and made many contributions in various fields. He is probably best known for his outstanding contributions in the field of Bioinorganic Chemistry, where he has studied the proteins active in photosynthesis, the enzymes that play a role in hydrogen metabolism (hydrogenases) and organic radicals and model systems in solution. Another important aspect of his work is the development and application of advanced EPR methods in different frequency bands, which is supplemented by quantum chemical calculations and other spectroscopic techniques. With this research portfolio, he has been at the forefront of the search for clean, renewable energy sources, which the world desperately needs when the times come that fossil fuels become increasingly scarce. Moreover, he has organized numerous conferences on various research topics in EPR research; he received the Zavoisky award (2002), was awarded the Bruker prize (2003), became a Fellow of the Royal Society of Chemistry (2004), became a member of the Council for the Meetings of the Nobel Laureates in Lindau (2004), received the IERS gold medal (2005), has actively contributed to the IERS in his function of president (2005-2008), and received a prestigious honorary doctorate at the University of Uppsala (2008). And this is just the tip of the iceberg of his impressive list of awards, functions and achievements! On a personal note, somewhere down at the bottom of that iceberg, he gave me a second chance in the EPR research field after a rather unsuccessful career in industry. I cannot put into words how grateful I am to him for that.

Wolfgang Lubitz, born 1949 in Berlin, studied chemistry at the Freie Universität (FU) Berlin (1969–1974), where he also received his doctoral degree under the joint supervision of Prof. Harry Kurreck (Department of Chemistry) and Prof. Klaus Möbius (Department of Physics) (1977) and did his habilitation in organic chemistry with support of Prof. Harry Kurreck (1982). The book which he coauthored with Harry Kurreck and Burkhard Kirste on Electron



Nuclear Double Resonance Spectroscopy of Radicals in Solution (VCH Publishers 1988) has become a standard reference for anyone who measures EPR, ENDOR and TRIPLE spectra of organic radicals in liquids. From 1983 to 1984 he worked as a Max Kade Fellow at UC San Diego (department of physics) with Prof. George Feher, where he had his first experiences with photosynthetic proteins and protein purification techniques. This cooperation has been so enjoyable that Wolfgang still frequently visits his friends and former colleagues in the San Diego area. Moreover, the multiple disciplines, besides, obviously, ENDOR spectroscopy (see the *EPR newsletter* vol. 19, issue 1-2, page 25), to which he became acquainted at the UCSD turned out to be extraordinarily useful during his entire career as a researcher in Bioinorganic Chemistry. From 1979 to 1989 he worked as assistant and associate professor at the FU Berlin and from 1989 to 1991 as professor at the Universität Stuttgart (experimental physics/biophysics) closely linked to Prof. Michael Mehring.

From 1991 to 2001 Wolfgang Lubitz worked as a full professor of physical chemistry at the Max Volmer Institute for Biophysical Chemistry at the Technische Universität (TU) Berlin. His group at the TU Berlin, in particular with Dr. Friedhelm Lenzian and Prof. Robert Bittl as senior researchers then

strongly focused on photosynthetic research, which, in the words of his colleague Prof. Arnold Hoff, has also been termed as “the Garden of Eden of EPR spectroscopy”. His group, along with his close colleagues at the FU Berlin arguably turned the city of Berlin into the center of EPR research or the “Mecca of EPR spectroscopy” during this time period. It is unlikely that such a strong focus in EPR spectroscopy will be achieved again by any group or nearby groups in the near future. Wolfgang, along with his friend and colleague Klaus Möbius are probably the only two who had the good fortune and pleasure to be a part of both in the Garden of Eden as well as the Mecca of EPR spectroscopy.

Wolfgang’s outstanding research did not go unnoticed in Germany, and in 2000 he became a Scientific Member of the Max Planck Society and accepted the prestigious Directorship at the Max Planck Institute for Radiation Chemistry in Mülheim an der Ruhr, which was later renamed to the Max Planck Institute for Bioinorganic Chemistry. His laboratories presently include a staggering 10 EPR spectrometers from low to high microwave frequencies, available for continuous-wave and pulsed EPR experiments. This makes his EPR laboratories worldwide unique and a pleasure to work in. Moreover, based on his experiences at the UCSD, his laboratories are fully equipped with biochemistry laboratories as well. Wolfgang Lubitz is member of the International EPR/ESR Society (IES), ISMAR and AMPERE Society, the International Photosynthesis Society, and several other professional organizations such as the GDCh and ACS. He is on the editorial board of five journals. Wolfgang Lubitz is (co)author of more than 300 publications in scientific journals and has contributed to books and written about 20 review articles. It is my honor to congratulate Wolfgang and his wife Gisela. Happy 60th Birthday, thank you for the past six years of hospitality – and long live Bioinorganic Chemistry!

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EPR@ANL – A Preamble

John A. Weil

The Argonne National Laboratories, located in the southwest suburbs of Chicago, served for decades as a provider of fine research in magnetic resonance. The Lab was divided into individual Divisions, such as the Chemistry Division, Solid-State Science Division, Applied Mathematics Division, etc. Electron paramagnetic resonance (EPR) spectroscopy thrived at ANL (as it did in some other National Laboratories, e.g., Oak Ridge)

One of the early pioneers doing EPR at ANL was Bernard Smaller, who often collaborated with other staff members, publishing works from 1953 until his death in 1972. The group specialized in short-lived free radicals created by photolysis and pulse radiolysis, and in energy-transfer considerations.

Philip H. Yuster and his colleagues (often Charles J. Delbecq) worked from some decades on optical and magnetic properties of alkali halides and similar solids, often irradiated, publishing a set of superb EPR papers from the mid-fifties until the early 1980s. Many visitors were attracted to this group, to collaborate on this broad project.

The SSS Division also was home for decades (1960–1980) to a productive resonance expert: Donald E. O'Reilly. Besides much work in NMR, experimental and theory, Don published a series of EPR studies, including work on EPR relaxation times of metal/ammonia solutions, transition-ions in catalysts and ferroelectrics, and gamma-irradiated materials.

John A. Weil arrived at Argonne in 1959, from Princeton, as a staff member of the Chemistry Division. Having been treated to a brand-new cw Varian spectrometer, and with the advent of fine postdocs and undergrad students, he initiated a research program mostly focused on chemical EPR spectroscopy. One specialty was the study of magnetic point defects in irradiated crystalline quartz, a plethora of which were discovered and characterized in intimate detail by the group. A second major research topic was the study of dioxygen carriers, primarily paramagnetic binuclear cobalt species. Various organic free-radical systems, e.g. hydrazyls and nitroxides,



EPR spectroscopy at ANL in 1963. John Weil (1929–) and ACM undergrad research student Donella (Dee) Hager-Meadows (1941–2001) from Carleton College. Dr. Meadows (later: PhD Harvard and Lifetime Professor at Dartmouth College) became world-famous for her authorship of *“The Limits to Growth”* (1972) – as sponsored by the Club of Rome.

constituted another focus. The Weil group also became nicely involved with the newly discovered (at ANL) inert-gas compounds, e.g. the use of XeF₂ as an agent to generate fluorinated organic free radicals. Another specialty was the continued development of magnetism theory, e.g. crystal-symmetry and also powder aspects of spin-hamiltonians, including a major computer-based analysis program. Lastly, a new type of cryogenic

goniometric capability, using closed-cycle helium gas compression and expansion, was developed by the group. John left ANL with some regret, in 1971, to take on a professorial position in Canada.

Marion C. Thurnauer, in a separate major essay, covers the development of the time-resolved and pulsed EPR in ANL's Chemistry Division, which led to much insight especially into photosynthetic material. ●

Electron Pairs and Other Radical Colleagues at Argonne National Laboratory

Marion C. Thurnauer

As I look back and try to distill events that pertain to my experiences with EPR spectroscopy at Argonne National Laboratory (ANL) during the years I spent there (1974–2004), I think it is enlightening to place these thoughts within the context of the environment of the US National Laboratories, and Argonne, in particular.

The first National Laboratories (Labs) were established by the United States Atomic Energy Commission (AEC) right after World War II, and were the direct descendants of the Manhattan Project [1, 2]. Argonne was officially established in 1946 [3]. The Labs were founded to provide the facilities and environment for performing basic research in support of nuclear energy. For example, in the case of research in the field of chemistry, two subjects in the early days were fundamental heavy element chemistries/separations and fundamental understanding of the radiation chemistry of water. Both topics were relevant to development of light water nuclear reactors and the associated issues. Also, radiation damage in solids and solutions was deemed to be relevant.

In establishing the Labs, the U.S. government recognized that a special management system was required in order to provide and maintain the freedom and flexibility necessary for performing basic research. Thus, the National Labs are to this day managed by a formula in which independent managers are hired by the government to operate the Labs, where the contractor is often an academic institution or similar nonprofit organization. Since its inception, ANL has been managed, under renewable contracts by the University of Chicago. Owing to this scheme, the environment at Argonne, during its early years, was such that scientists were not burdened by bureaucratic paperwork and enjoyed considerable freedom and support in their research.

Joseph J. (Joe) Katz joined the ANL Chemistry Division during these early days. In a retrospective article “Green thoughts in a green shade” [4], he describes how “the Director of the Chemistry Division fostered a stimulating research atmosphere, and the Laboratory

provided unmatched material support.” Joe Katz initiated a successful research program in actinide chemistry. However, in the mid-1950s he was approached by an emissary from the Atomic Energy Commission with an offer (at no cost) of a 55 gallon drum of 99.7% D₂O. Joe readily accepted the offer. He wrote: “... I felt that with an essentially unlimited supply of such a rare commodity something of scientific interest would surely turn up.” [4]. As they say, “The rest is history”. This incident, together with the choices Joe made as to how to ‘spend’ the D₂O, ultimately led to ANL’s research program in the developments and applications of EPR to probe structure and function in photosynthetic systems. [I refer here primarily to developments with which I am most familiar: those that occurred in the ANL Chemistry Division during or near the time of my tenure at ANL. See EPR@ANL – A Preamble by John Weil for a listing of EPR work prior to this period.]

Joe describes how, after accepting the D₂O, he and his collaborators at ANL embarked on a research program to investigate the biological consequences of the replacement of hydrogen by deuterium (¹H by ²H) in living organisms [4]. Joe and his colleague Henry L. Crespi found that a large number of microorganisms could be cultured in 99.7% D₂O. Choosing to grow autotrophic organisms, those requiring only inorganic nutrients, they discovered that green algae adapted readily to heavy water. Subsequently, these deuterated organisms were used for culturing more nutritionally demanding organisms, and Joe and his colleagues succeeded in growing fully deuterated photosynthetic bacteria. Ultimately, the stable isotope replacement studies were extended to carbon-13, oxygen-18, and nitrogen-15.

Having the fully deuterated photosynthetic organisms, Joe embarked on photosynthesis research. He initiated a program to isolate and characterize photosynthetic pigments, and undertook a study of the chemistry of chlorophylls. For the rest of his long career, he maintained his strong interest in understanding the chlorophylls’ behaviors in various environments (e.g., formation, through self-aggregation, of long-wavelength forms of chlorophyll; the formation of photoac-

tive chlorophyll-water hydrates). In turn, he was interested in understanding the relationships between the chlorophylls’ versatile chemical behaviors and their structures and functions *in vivo*.

Joe was introduced to EPR and free radicals in photosynthesis by Barry Commoner, Washington University, St. Louis. Commoner, a distinguished biologist who ultimately became a prominent environmental activist, had discovered in 1956 that intact photosynthetic systems and chloroplast preparations exhibit a light-initiated, reversible EPR signal. The origin of this so-called signal-I was not known. With the availability of deuterated algae from ANL, Commoner reported convincing proof that signal-I was due to oxidized chlorophyll. Thus, Joe Katz realized the value of EPR spectroscopy for providing new details about the roles of chlorophyll in the primary light conversion events of photosynthesis. “I approached several experienced EPR spectroscopists, but I was unable to interest anyone in a collaboration. I therefore proceeded to set myself up for EPR work. That I was allowed, and even encouraged, to do so despite my inexperience in magnetic resonance spectroscopy demonstrates one of the advantages of life at Argonne.” [4].

The brief historical account above describes how the unique management structure of the National Labs was effective in creating an environment that promoted and supported science. Not surprisingly, much changed in the ensuing years. The AEC was abolished in 1977, and after a short stint under the Energy Research and Development Administration, the National Laboratories fell under the aegis of the Department of Energy (DOE), a diverse organization with ‘science’ being only one of its many missions. The Labs’ relative independence from bureaucratic restrictions and political pressures, eroded. Over the years, ANL scientists were spending more and more time on the paperwork required to comply with extensive regulations associated with procurement, assessments, and EHS (Environmental Health and Safety). Additionally, the political pressures that came with shifting national priorities coupled with reduced funding forced the Labs to continually redefine their missions. Nevertheless, I

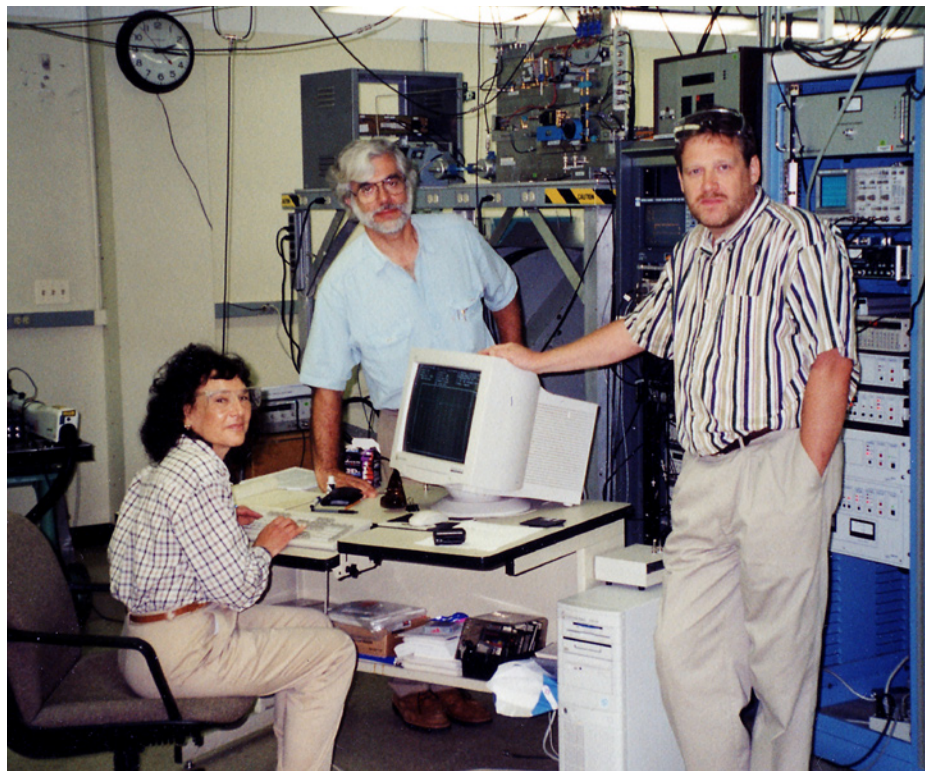
believe that within the confines of ANL's Chemistry Division, the corporate memory of the seemingly idyllic environment for basic research survived, if not in reality, but in our "approach" to science. This was a key factor that drove the research, developments, and applications in EPR described below. The fact that we were almost 'required' to perform a 'brand' of research distinct from that in academia, fostered unique research programs that integrated specialized expertise and research tools. Our research programs brought together scientists (including permanent ANL staff, postdoctoral associates, students, visiting scientists) from the laboratories of prominent EPR spectroscopists around the world, resulting in a vital diversity of 'EPR genes'. Unfortunately, in this relatively short article, I am not able to mention all of these scientists.¹

The stories I present are based mostly on my memories, including stories retold to me. I would be delighted if this article stimulates comments and perhaps a future article that includes someone else's memories. As I do not present a review of the literature, the essential aspect of science, i.e., the interplay between the research from different laboratories worldwide, is not discussed.

EPR and the Special Pair in Photosynthesis

In 1968 James R. (Jim) Norris came to work as a post-doctoral associate in the ANL Photosynthesis Group led by Joe Katz. Jim had received his PhD at Washington University where he had worked with Sam Weissman. In short order, Jim published seminal work in which he proposed and demonstrated that the primary electron donor (signal-I) in both oxygenic photosynthesis and in purple photosynthetic bacteria consists of a

¹ As an aside, many people who visited ANL have memories of the white deer that roamed the campus, and still ask about them. Contrary to urban legends, the deer did not turn white following a laboratory experiment that involved radioactivity. A small number of these deer, known as Dama dama, roamed the private estate that became ANL. I watched the white deer's situation change during the time I spent at ANL. I remember during my first few years at ANL one would see many deer grazing or standing near the warm buildings in winter, particularly after dark. At one time, perhaps in the 1980's, there were so many deer that a large number of them were herded and shipped to Wisconsin. After that, the number of native white-tailed deer increased, and the population of the white deer remained relatively low. According to the fact sheet on the deer available at: www.anl.gov/Media_Center/Fact_Sheets/white_deer_fact_sheet.pdf, as of May 2008, there were only 30 white deer at Argonne and 60 native white-tailed deer.



Marion Thurnauer, Alex Trifunac and Oleg Poluektov examining data in 'Oleg's' high-frequency (D-band) EPR lab. Photo taken by Vladimir Krymov in 2004.

pair of chlorophyll (or bacteriochlorophyll) molecules.

Briefly, when compared to the Gaussian lineshape EPR signals of oxidized chlorophyll and bacteriochlorophyll, the photo-initiated EPR signal-I from green plants and purple bacteria, displays a narrowed Gaussian linewidth. Thus, signal-I was considered to arise from photo-oxidation of specialized chlorophyll molecules situated in the reaction centers. It was suggested that these chlorophylls were made 'special' by unspecified environmental factors or unspecified chlorophyll-protein, lipid, or chlorophyll interactions.

Jim compared the EPR spectra of signal-I from a number of photosynthetic organisms (¹H and ²H) to EPR signals of oxidized chlorophylls (¹H and ²H), and found the linewidths of the signals from the natural photosynthetic systems were uniformly reduced by a factor of the square root of 2 (~40%). He demonstrated that this is the expected reduction factor for the case of electron (hole) delocalization over two chlorophyll molecules. Jim and Joe coined the name 'special pair' for the *in vivo* electron donor chlorophylls.

EPR of Photoexcited Triplet States in Photosynthesis

Shortly before I came to ANL in 1974 as a post-doctoral associate, Jim Norris had ini-

tiated a study of the EPR properties of the photoexcited triplet states observed in the isolated chlorophylls and in purple photosynthetic bacteria. He employed light-modulation techniques whereby the light-dependent signal is phase-sensitive detected with respect to the light modulation frequency. I recall that Jim was waiting for delivery (from ANL's Electronics Group) of two light modulators, based on Sam Weisman's design, which provided both current and light-level feedback to give a stable, consistent and deeply modulated light signal. Thus, when I began working with Jim, I was introduced to: the concepts of time-resolved (TR) EPR, i.e., matching the frequency response of the monitoring system with the time constant of the transient signal and, importantly, to the fascinating world of photosynthesis. I was captivated by the highly electron spin-polarized, highly reproducible, photo-initiated transient EPR signals (in this case triplet state) elicited by the photosynthetic reaction center (rc) protein.

Employing light-modulation EPR methods, we studied the EPR properties (zero-field splitting parameters, electron spin polarization (esp), kinetics) of the transient triplet states of monomeric chlorophylls. The esp patterns and triplet sublevel kinetics that we observed from the chlorophylls could

be explained, as expected, by the spin-orbit induced intersystem crossing mechanism. Compared to the chlorophyll triplet states, the triplet EPR signal from photosynthetic rc proteins is anomalous. In 1972 J. Leigh, P. L. Dutton, and M. Siebert had reported observation of an intense highly electron spin-polarized EPR spectrum of a triplet state from purple photosynthetic bacterial rc proteins in which the primary quinone electron acceptor had been reduced prior to light excitation. The zero-field splitting parameters of the *in vivo* triplet spectrum are reduced, compared to those of monomeric bacteriochlorophyll, and the esp was unusual in that it implied that the T_0 spin sublevel has an excess of population for all canonical orientations. We determined that the parameter $D > 0^2$ for the *in vivo* triplet state. This result proved that the strong esp was the result of overpopulation of the T_0 spin sublevel and not the T_{+1} sublevels. We proposed that the so-called T_0 esp was the result of radical pair intersystem crossing to the excited triplet state. The mechanism demonstrated that the triplet state is not on the main photosynthetic pathway. Nevertheless, innumerable studies have taken advantage of the unique properties of this triplet state for obtaining, not only detailed understanding of structure and function in photosynthetic rcs, but also insights into 'spin chemistry'.

TR EPR Methods and CIDEP in Liquid Solution (Pulse Radiolysis)

Bernard (Bernie) Smaller (see EPR@ANL – A Preamble) is credited with performing in 1968 at ANL the first microsecond TR EPR experiments of paramagnetic transients in liquids. To increase the spectrometer response time he employed 2.1 MHz field modulation to monitor radicals formed by energetic electron pulses from a Linac or van de Graaff accelerator. The time resolution he achieved was about 2 μ s.

Smaller also observed Chemically Induced Dynamic Electron Polarization (CIDEP), i.e., esp, from the transient cyclopentyl radical (formed by radiolysis of cyclopentene). This result showed that CIDEP is a general phenomenon, and not restricted to the hydrogen atoms which were previously studied in 1963 by Fessenden and Schuler in steady-state EPR radiolysis experiments. Furthermore, Smaller and co-workers reported the first EPR detection of the hydrated electron³, and his TR EPR studies provided new details of hydrogen radical reactions in radiolysis.

Alexander D. (Alex) Trifunac came to ANL to work with Joe Katz as a post-doctoral associate in 1972. He 'paid his dues' with Joe and published two papers with Katz that described the optical spectroscopic properties of chlorophyll-water hydrates. About that time, Joe 'inherited' the EPR equipment that Smaller had constructed and used. Joe gave Alex the assignment to 'do something' with Bernie Smaller's EPR equipment. This new assignment was particularly ideal for Alex as his thesis work with Gerhard L. Closs, University of Chicago, had established the radical pair mechanism of Chemically Induced Dynamic Nuclear Polarization (CIDNP). On the other hand, at the time, the mechanisms of CIDEP were still under considerable debate in the literature. Most importantly, it was clear that TR EPR with the associated observation of CIDEP could be developed into a powerful tool to probe chemical mechanisms.

Alex undertook experiments with the EPR spectrometer having 2 MHz field modulation to study radicals generated in liquid solutions with electron pulses from the 3 Mev van de Graaff accelerator at ANL. His initial experiments were aimed at finding experimental evidence for the involvement of radical pair (rp) CIDEP in pulse radiolysis. He clearly demonstrated the dominance at X-band microwave frequency of S- T_0 rp polarization. Importantly, he demonstrated the *g*-factor dependence of the esp, produced when the *g*-factor differences between the radicals in a radical pair are relatively large, and also the S- T_{-1} rp esp in the case of very large hyperfine splitting, e.g., hydrogen atom, and in cases of restricted diffusion such as in micellar systems and viscous solutions.

The 2 MHz field modulation approach to TR EPR has certain limitations: time resolution is limited to about 1 μ s and 2 MHz sidebands accompany narrow EPR signals. Although other laboratories had taken Smaller's lead of employing 1 or 2 MHz field modulation, further development of TR EPR techniques at ANL led to 'direct detection' (or transient nutation) methods whereby field modulation is eliminated altogether. Working with a talented electronics engineer, Kenneth Johnson, Alex considerably upgraded the Smaller spectrometer and constructed a direct detection spectrometer. The direct detection approach was greatly facilitated by the gain in sensitivity achieved because CIDEP signal enhancement is the rule rather than the exception in TR EPR experiments and the relatively large concentration of radicals that is produced with radiolysis. In general, with direct detection methods time resolution had moved to the sub-microsecond range.

Although Alex was quite successful in 'doing something' with the EPR spectrometer, including its total upgrade, he was not working with chlorophylls. Therefore, Joe Katz was not interested in the research and arranged for Alex to be transferred, within the Chemistry Division, to the Radiation and Photochemistry Group.

TR EPR Methods and CIDEP in Liquid Solution (Laser Photolysis)

Around 1978 we acquired our first pulsed laser, a Molelectron N₂ 1 MW laser. Using this laser as our excitation source and feeding the signal directly from the output of the mw-diode in a Varian E-line microwave bridge (unmodified except for addition of a fast preamplifier) we readily observed transient radicals from, for example, the photoreduction of benzophenone by isopropanol. The signals exhibited CIDEP that could readily be attributed to both rp and triplet mechanism esp; the relative magnitudes of the contributions of the two effects showed a dependence on the magnitudes of the hyperfine couplings of the two radicals, as predicted.

TR Pulsed EPR Methods

Michael K. (Mike) Bowman came to ANL in 1976 as an NSF post doctoral fellow to work with Jim Norris. He had received his PhD with Larry Kevan at Wayne State University and shortly after arriving at ANL spent several months in Yuri D. Tsvetkov's laboratory in Novosibirsk. With this

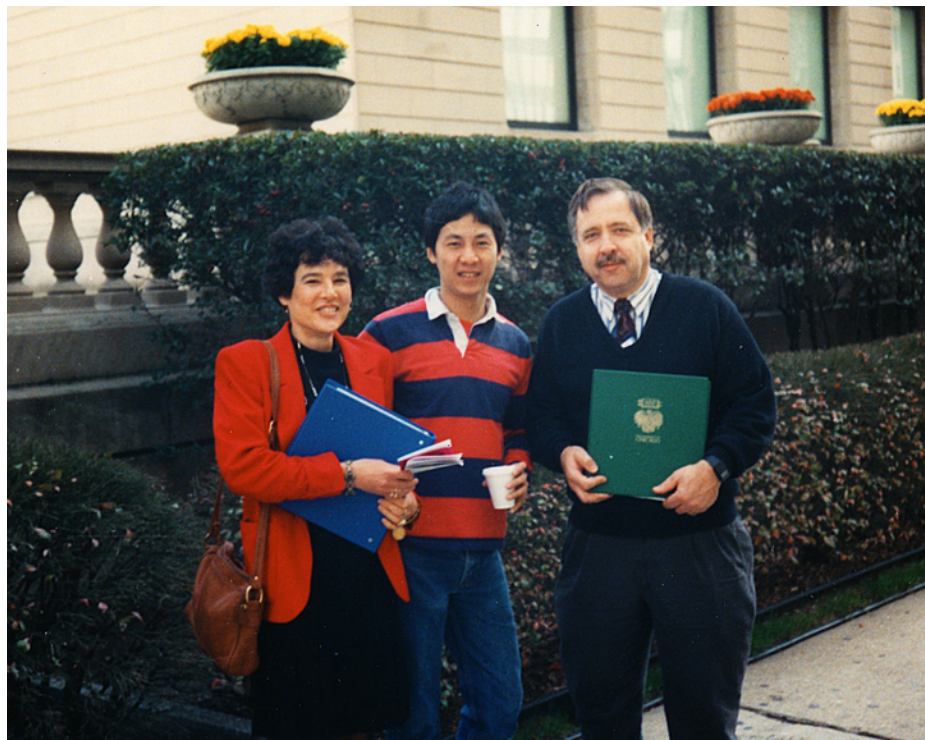
² The usual methods for determining the sign of *D* could not be employed with the *in vivo* triplet signal because of the esp and the localization of the triplet state on a pair (with unknown structure) of bacteriochlorophyll molecules. Jim Norris devised a clever method to determine the sign of *D*. The scheme makes use of the interplay between spin-lattice relaxation times and light modulation frequency. As evidence of how much this question had been on my mind – several years after we determined $D > 0$, I was standing in the check-out line at the supermarket, when I heard a voice in my ear ask, "What is the sign of *D* for the triplet state in purple photosynthetic bacteria?" I turned around to find David Budil.

³ It should be noted that the hydrated electron was discovered in 1963 by an ANL chemist, Edwin Hart, and a British colleague, J. W. Boag.

background, Mike brought pulsed EPR to ANL. This was an opportune time to develop a pulsed EPR system, since compact solid-state microwave devices had become available. The first pulsed bridge that Mike designed and constructed was a relatively low-power bridge, having only a 10 Watt TWT (traveling-wave tube amplifier). This bridge was used for the experiments described below.

Alex Trifunac and Jim Norris realized that by employing electron-spin echo techniques to monitor transient radicals formed from pulsed laser excitation, some disadvantages of TR cw EPR could be avoided. Thus, in 1978 they successfully performed the first nanosecond time-resolved EPR experiment on transient radicals in liquid solution. The time resolution was ~20–30 ns, determined by the width of the first (90°) microwave pulse, in a two-pulse electron spin echo (ESE) experiment. They demonstrated the technique with the benzoquinone ketyl, durosemiquinone, and isopropyl radicals, generated by laser photolysis of benzoquinone and duroquinone in isopropanol, respectively. Alex presented these results at a Workshop on Chemically Induced Magnetic Polarization, Queen's University, Kingston Ontario. The participants were most of the major players in the nuclear and electron spin polarization 'game'. Sam Weissman, who chaired the session in which the work was presented, gave a nice (and important) endorsement when he said to the effect⁴, 'When I heard that they were going to try this experiment, I was sure it would not work. However, the EPR magnet must have had enough field inhomogeneity to make it possible to observe an electron spin echo signal in liquid solution.' In fact when Alex proceeded to develop the TR ESE technique for radiolytically generated radicals, he included a variable magnetic field spoiler in his instrument design.

I learned a lot and had much fun as a witness and participant in some of the events described above. I remember observing as Ronald G. (Ron) Lawler from Brown University (who spent a Sabbatical year at ANL) and Alex played spin gymnastics in real time – flipping pulses and changing pulse sequences to see the effect on the spin echo that was visible on the scope. It was all very



Marion Thurnauer, Richard Rustandi (University of Chicago student with Jim Norris, performed some of his thesis research at ANL, thesis title: *Electron Spin Polarization and the Role of Vitamin K1 in Photosystem I.*) and Jim Norris. Photo taken in front of Art Institute of Chicago in 1991.

educational and entertaining, not only to see 'spins in action' but also to learn about the limits of power that the expensive microwave switches could handle. It was a big deal to 'blow' one of the switches.

I soon began to perform TR ESE experiments on whole cells of the cyanobacterium, *Synechococcus lividus*. Once at a poster session I was asked whether I chose to study *SynECHOoccus*, with electron spin ECHO methods for the obvious reason. Actually, that relationship had not occurred to me. I chose it because large amounts of *S. lividus* (99% deuterated) were available in our lab, as this thermophillic cyanobacterium was used to obtain deuterated extracts for growing other bacteria. On the other hand, only a very small supply of native, protonated cells was available.

I readily observed strong electron spin polarized signals within 40 ns of laser excitation from the deuterated samples. The most difficult part of the experiment was determining how much I needed to dilute the thick, dark-green samples in order to obtain an optimum ESE signal. Today the expression 'way cool' comes to mind when I think about my reaction to these experiments and my introduction to the power of ESE techniques. We demonstrated three modes of data collection: i) echo-induced

EPR obtained at different delay times with respect to the radical-generating laser pulse – We observed a three-lobed spin-polarized (emission (e)/absorption (a)/emission (e)) signal. ii) kinetic traces obtained at different fixed magnetic field values – The rapid (instrument limited) inversion from e to a of one kinetic trace (obtained at high-field e resonance) could only be explained if the EPR signal was due to more than one radical. iii) ESE envelope modulation obtained at fixed delay times with respect to the laser pulse and fixed magnetic field values – The ESEEM pattern suggested that part of the signal (high-field e) was due to a chlorophyll-like cation radical. Surprisingly, the differences in intensities of the signals from the deuterated vs. protonated samples were much larger than expected from consideration of the differences in magnetic moments. A signal from protonated material was virtually not observable. Thus, I had been lucky because it was easier to obtain deuterated, as opposed to native protonated, *S. lividus* in our lab. Later, when we had determined that the signals were due to spin-correlated rps (scrps), we understood this anomaly, and furthermore, observed a relatively intense 'out-of-phase' transient EPR signal (see below) from both the protonated and deuterated samples.

⁴ To quote Haim Levanon in the *EPR newsletter* (2009), vol. 19, issue 1-2, Sam was "a scientist and a mensch!"

Comparisons of Approaches to TR EPR

The results of TR pulsed EPR methods, led to many discussions (and debates), in our labs, at conferences, and in the literature, about the relative merits of pulsed vs. cw TR EPR. The question of which approach could ultimately provide the highest time resolution became prominent. Initially, our discussions were focused on TR EPR spectra in liquid solutions, where linewidths are considered to be homogeneous, except for broadening due mainly to inhomogeneities in the external magnetic field (see above). In general, pulsed EPR was considered advantageous because it is inherently well suited for measuring dynamic properties of a spin system. The signal rise time is determined by the width of the initial microwave pulse, and the signal intensity is directly related to the transient magnetization created by the laser pulse. In the case of cw transient EPR, the continuous presence of the microwave field can make the situation more complex. The signal intensity is not simply related to the photo-induced magnetization unless the spin system is in steady state with the applied magnetic field, and approaching steady state depends on the relaxation properties of the sample exposed to the microwave field.

Around the time these discussions were taking place (1980) Reinhard Furrer, Free University Berlin, was spending a sabbatical with Clyde Hutchison at the University of Chicago. Reinhard came to ANL to perform TR EPR experiments. Reinhard and his colleagues in Berlin had published a paper having the conclusion that in the case of inhomogeneously broadened EPR lines (where $\gamma B_1 < \text{inhomogeneous linewidth}$), e.g., EPR signals from molecular crystals or photosynthetic rcs, the signal rise time in a transient EPR experiment is determined by the inverse of the inhomogeneous linewidth. However, Reinhard had been unable to demonstrate this experimentally as the time constant of the detection system he employed in Berlin was limited to 100 ns. He realized that components in our pulsed bridge could be reconstructed to provide a broadband cw system with an instrumental time constant of ~5 ns. To my consternation, as I had become rather attached to, if not possessive of, the '10 W' pulsed spectrometer (associated with laser photolysis), he eagerly suggested that we reconstruct the pulsed system into a cw microwave bridge. Subsequently, we demonstrated with the triplet state EPR signal of phenazine-d₈ doped in a crystal of fluorene that the time resolution of the EPR transient

method (direct detection) can be very high. For an inhomogeneously broadened line with 15 G linewidth, we observed a rise time τ of ~15 ns and demonstrated that τ is sensitive to both the line form and width. Following these experiments, I was eager to return the bridge back to its pulsed configuration.

Thus, with the provision of broadband detection schemes and use of special microwave resonators, the time resolution of cw transient and pulsed EPR techniques are comparable and typically are on the order of tens of nanoseconds. Two reviews from ANL present detailed discussions of the considerations mentioned above, along with other important issues regarding TR EPR methods: J. R. Norris et al. [5] and A. D. Trifunac et al. [6].

These reviews also describe much of the EPR research that was underway at ANL. For example, ref. 5 includes summaries of echo spin envelope modulation (ESEEM) studies, as well as, relaxation and distance measurements performed by Mike Bowman and Jim Norris. Reference 6 includes summaries of dynamic polarization recovery experiments that yield relaxation data for radicals formed by pulse radiolysis, performed by David Bartels, Ron Lawler and Alex Trifunac, and descriptions of optically detected EPR studies of radical ions performed by Joseph Smith, Steven Lefkowitz and Alex Trifunac.

TR EPR Studies of Photosynthetic Rcs

"The usefulness of such limited comparisons of cw vs. pulsed EPR methodology is questionable, since the choice of technique must depend on the kind of information desired" [6]. The two approaches can be applied to obtain complementary information. This point has been particularly valid in TR EPR studies of photosynthetic rcs, where the signals monitored exhibit esp of correlated rps.

We were able to attribute the esp EPR signal observed in our initial ESE experiments with photosynthetic systems to at least two radicals (see above). Further interpretation was not straightforward because at X-band microwave frequency the signal was comprised of only three lobes. Jim Norris asked the important question 'Was the signal phase $e/a/e$ or $a/e/a$?' While trying to make this determination, I was surprised to find that the maximum echo appeared 90° out of phase with respect to that of a signal from a stable radical. This 'out-of-phase' EPR sig-

nal (lifetime ~200 ns) was not three-lobed, but appeared as a single inhomogeneously broadened line with linewidth and ESEEM pattern characteristic of the chlorophyll primary electron donor (signal-I). We interpreted the time-dependent ESE phase shift by a mechanism that attributed the 'in-phase' three-lobed signal (determined in the same experiment to be $e/a/e$) to a correlated rp, composed of oxidized electron donor and reduced electron acceptor. We, and others, also observed the same three-lobed signal at X-band with TR cw techniques.

The characteristic $e/a/e$ pattern was exceptional, particularly for a rp. Additionally, at that time, the CIDEP literature pertained mostly to radicals in liquid solution and the initial electron donors of the Photosystem I rcs⁵ had not yet been identified.

Numerous studies involving the judicious use of isotopes in sample preparation and multifrequency⁶ EPR were required to ultimately determine that: i) TR EPR experiments monitor the important charge-separated state between the oxidized primary electron donor and reduced quinone acceptor of photosynthetic rcs; ii) the charge-separated state is a scrp; iii) a general model of sequential electron transfer spin polarization (setp) is required to describe the esp exhibited by the charge-separated state wherein the esp pattern depends on the lifetime of the rp that precedes the scrp. Seth W. Snyder (a post-doctoral associate who worked with me) and I have summarized our research that led to these conclusions [7].

Jim Norris devised an informative vector diagram approach for understanding and applying the general model of setp [8].

Jau Tang who came to ANL in 1981 after receiving his PhD with Alex Pines, and Andrea Morris, a University of Chicago student

⁵ Several other experiments determined that these signals from *S. lividus* derived from Photosystem I of oxygenic photosynthesis.

⁶ In 1981 when Reinhard Furrer returned to Berlin, he took a sample of freeze-dried *S. lividus* to examine with K-band (24 GHz) direct detection time resolved EPR. When I phoned him to ask about the result, his first comment was that his lab, with the sample flowing through his cavity for several days, smelled as if he were sailing along the Havel in Berlin. We also ran a Q-band (35 GHz) experiment when Peter Gast, who came from Arnold Hoff's lab to ANL as a post-doc, and I hauled the light modulation setup to Milwaukee to James Hyde's National Biomedical EPR Center. Both experiments demonstrated that the three-lobed (X-band) signal was due to two radicals (with the suggestion that one was a quinone) and the esp could not be explained by the CIDEP mechanism, as had been proposed in the literature.

with Jim Norris, contributed to the development of the theory of scrp.

The discovery of the phase shift and the scrp ultimately was an exciting result, as the electron and nuclear spin effects associated with the scrp phenomenon in photosynthetic rcs continue to provide a fascinating 'test bed' or 'playground' for the development of advanced theoretical and experimental approaches in magnetic resonance. Based on the scrp model, several spin phenomena have been explained and/or predicted. One example, which also illustrates the complementarity of pulsed vs. cw TR EPR, is the quantum beat phenomenon observed at short delay times after optical excitation. Gerd Kothe, University of Freiburg, observed quantum beat oscillations from photosynthetic rc proteins by employing high time resolution (~40 ns), transient nutation (direct detection) cw EPR. (Jim Norris, under the auspices of a Humboldt Fellowship, was working with Gerd at the time.) Gerd has extensively developed this approach. He, and his colleagues, obtain what appear to be 'noise free' three-dimensional (time, magnetic field, intensity) spectra showing both electron and nuclear quantum beat oscillations. These studies have provided details of the three-dimensional structure of the secondary rps (charge-separated state) formed in photosynthetic rcs and the opportunity to relate protein function to dynamic structure. These studies also were facilitated by the availability of deuterated photosynthetic material from ANL.

Electron Spin Polarization in Photosynthetic 'Model' Systems

We have often pointed out that the shared characteristics of the different rc proteins, revealed through TR EPR, reflect the underlying structural and energetic requirements for efficient charge separation. In other words, as with the T_0 spin-polarized triplet state observed in photosynthetic rcs, the scrp esp turned out to be the 'exception that proved the rule'. Duplication of either the T_0 polarized triplet state and/or correlated rp esp remain rigorous criteria for designing and synthesizing an electron transfer system that can mimic photosynthetic solar energy conversion.

Michael R. (Mike) Wasielewski reported nice examples of systems that model the esp observed from photosynthetic rcs. He designed and synthesized donor-acceptor molecular triads that successfully mimic the scrp esp found in the photosynthetic rcs. Significantly, in a different molecular triad,

he also successfully reproduced the charge recombination T_0 spin-polarized triplet state observed (prior to Mike's report) only in photosynthetic rcs. The latter work was in collaboration with Haim Levanon, Hebrew University, Jerusalem, who was often a visiting scientist at ANL.

In 1995, Tijana Rajh joined the Photosynthesis Group at ANL and brought us into the 'nano world'. She developed methods to modify the surface of nanocrystalline TiO_2 with endiol ligands, whereby the localized orbitals of the attached ligands are electronically coupled with the delocalized conduction band of the TiO_2 particles. Photoexcitation of this hybrid material results in instantaneous formation (i.e., no intervening step such as occurs in a dye-sensitization process of charge separation) of electron-hole pairs, where the hole is on the organic modifier and the electron is in the conduction band of TiO_2 . With TR EPR, these electron-hole pairs exhibit many of the characteristics of the scrps of the photosynthetic rcs.

EPR at ANL today

A future ISP Newsletter article describing EPR at ANL in the 21st Century would depict an ANL different from the one I have described. Although, I look forward to reading such an article, I mention a few points.

Today the Photosynthesis Group at ANL maintains a strong, albeit reduced in size, EPR program. Oleg Poluektov joined the ANL staff in 2000. He received his PhD working with Ya. S. Lebedev and was a visiting scientist in Jan Schmidt's laboratory. Thus, Oleg introduced us to high-field/high-frequency EPR. He continues to report novel developments and applications of high-field (D-band, 135 GHz) EPR, such as TR scrp ENDOR. Lisa Utschig introduced bio-inorganic chemistry to the Photosynthesis Group. She has discovered previously unknown metal-ion binding sites in the photosynthetic rc proteins, and applies cw and pulsed EPR to characterize these sites. The important common thread with the past remains: the deuterated photosynthetic organisms are maintained⁷ and continue to play a special role in the magnetic resonance studies of photosynthesis.

Additional EPR activities are underway at ANL. For example, an outgrowth from the Photosynthesis Program is that EPR spectroscopy is available to scientific users

⁷ Arlene Wagner keeps the isotopically substituted organisms alive and growing.

of the new Center for Nanoscale Materials, through the programs of Tijana Rajh and Nada Dimitrijevic.

Some final words

Laila Mosina asked me if I would write about the history of EPR at ANL. In this article I have selectively scratched the surface of such a story. Many exciting developments related to EPR and their scientific outcomes are not included, as I focused on my own experiences. In writing this piece, I came to appreciate even more the concept that inspired the title: the importance of the diversity of 'EPR genes'. Yet, I was unable to mention the contributions of many 'radical colleagues'. I hope I have conveyed to today's EPR student, who walks into the lab and finds a spectrometer (very likely a commercial pulsed spectrometer) that looks and 'feels' like a computer, that the field of EPR, particularly TR EPR, has come a long way in three decades.

Acknowledgment

I acknowledge Alexander D. Trifunac for input to the article.

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Professor Jan Wincenty Stankowski (1934–2009)

Professor Jan Stankowski died in Poznań, Poland on 4 September 2009 at the age of seventy-five. We have lost a prominent scientist, a specialist in molecular physics and condensed matter physics.

The scientific career of Professor Stankowski was really outstanding. He graduated from the Faculty of Mathematics, Physics and Chemistry at Poznań in 1956. In 1974 he became an associate professor, five years later a full professor, and in 1998 a full member of the Polish Academy of Sciences (PAS).

Professor Jan Stankowski was the main co-founder of the Institute of Molecular Physics PAS at Poznań (IFM PAN). He gathered young scientists together and was passionate of their endeavors. Professor Stankowski also designed scientific apparatus on his own: the first Polish MASER and the first Polish EPR spectrometer were constructed in his laboratory. He was a founder of the Polish school of phase transitions in solids



by radio-spectroscopy methods. Thanks to his activity and energy, an EPR spectrometer factory "RADIOPAN" selling their products in Poland and abroad was founded at IFM PAN. He was always interested in new trends in physics, most recently superconductivity and fullerenes, and undertook new subjects and created his own developments. He was a thoroughly educated physicist with an outstanding innovative spirit. He was a helpful friend of young physicists, inviting PhD students from many countries to his laboratory. He was convinced that the scientific community always extends beyond nationality. He enjoyed some popularity among secondary

school pupils thanks to the lectures on physics he gave to them in collaboration with the A. Mickiewicz University at Poznań. Another initiative of Prof. Stankowski addressed to gifted school pupils and university students was the annual "Summer with Helium" School (that has a 30-year-long history now) at the IFM PAN low-temperature laboratory at Odolanów.

Professor Stankowski was a member of the AMPERE Group and its Vice-President between 1990 and 2002. In 1993 he became a member of the Academy of Sciences of Slovenia. He initiated and organized the biennial Conference on Radio and Microwave Spectroscopy "RAMIS" that started in 1964 and was attended by specialists of many countries. Professor Stankowski published over 350 scientific articles and several books. He was the chairman of the Poznań Division of the PAS and, most recently, a member of the 5th Section of the Central Commission for Grades and Titles (a Polish governmental board accepting academic grades). He was also a member of editorial boards of several scientific journals. Over 30 PhDs, 15 associate professors and 5 full professors are among his former pupils.

He will remain our ever memorable friend who has trained many of us to experiment. He used to say he considered himself to be a happy man thanks to his successful family life and to physics.

Rest In Peace, Dear Jan.

Stefan Wapłak

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EPR2010 – A Joint Conference of the 14th In Vivo EPR Spectroscopy & Imaging and the 11th International EPR Spin Trapping/Spin Labeling Meetings

San Juan, Puerto Rico, May 2–6, 2010

www.epr2010.org

The EPR2010 conference will focus on a wide spectrum of EPR methods and applications including spin trapping, spin labeling, in vivo EPR spectroscopy, imaging, EPR radiation dosimetry and state-of-the-art EPR instrumentation in chemical and biological systems. Participants will include EPR scientists, junior faculty, young investigators, graduate and undergraduate and post-doctoral fellows from all over the world. One of the goals of this conference is to include, educate, and encourage women and minority students, as well as newcomers to the EPR field.

EPR2010 will maintain the traditional format of poster sessions and plenary lectures which highlight major advances in each of the major areas, and will feature short lectures from selected abstracts.

EPR2010 is being organized by Antonio Alegria (University of Puerto Rico) and Balaraman Kalyanaraman (Medical College of Wisconsin). Please visit the website for the full program and more detailed information. We look forward to seeing in you Puerto Rico!

Joint EUROMAR 2010 and 17th ISMAR Conference, (WWMR2010)

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Honolulu, Hawaii, USA, December 15–20, 2010

www.pacifichem.org



The 42nd Annual ESR Conference

The University of East Anglia,
Norwich, United Kingdom,
April 19–10, 2009

The 42nd Annual ESR Conference took place at the Ramada Hotel Norwich, hosted by The University of East Anglia, with

lectures in the City Suite Theatre and posters in the City Suite Reception Area.

The 2009 Bruker Prize Lecture by Professor Gunnar Jeschke (ETH Zürich Switzerland) spoke under the title: *Measuring the Nanoworld*.

Dr Christiane Timmel introduced the lecture, and in a fascinating talk from Professor



Jeschke we learned about the use of pulsed EPR techniques applied to measurements on and between nano-objects.

11 different countries, and once again over a quarter of the participants were graduate students, a situation that continues to suggest a healthy future for ESR spectroscopy.

The scientific programme was supported by social evenings and receptions sponsored by the ESR Group of the RSC, JEOL and Bruker. The free Tuesday afternoon allowed delegates the chance to explore Norwich and have a guided tour of Norwich Cathedral.

There were over 100 attendees representing.

Keynote lectures were presented by: Wayne Hubbell (UCLA), *Functional protein dynamics from site-directed spin labelling*; Fraser MacMillan (University of East Anglia), *Correlating the structure and function of proteins using EPR*; Martin Kaupp (Würzburg), *Quantum chemical calculations of EPR parameters as a tool to study metalloenzyme sites* and sponsored by the EPSRC National Service for cw EPR Spectroscopy; and Richard Cammack (King's College London), *Biochemical targets for advanced EPR weaponry*.

As well as the Keynote lectures we had a series of excellent invited and offered short talks, a poster session and the Bruker Lecture and the JEOL student talk session.

This year there were 35 posters and one was selected to win the poster prize with the traditional bottle of whisky going to Richard Ward (Dundee) for his poster: *PELDOR points towards local structural heterogeneity within a critical intermediate in nucleosome assembly*.

The poster prize winner and four runners-up, Kazuhiro Ichikawa, Muhammad Warsi, Dorith Wunnicke and Richard Brosi each received a copy of a recently published text on EPR spectroscopy, which included three copies of *High-field EPR spectroscopy on proteins and their model systems*, by Klaus Möbius and Anton Savitsky, these copies being generously donated by the publishers, the Royal Society of Chemistry.

The JEOL prize medal attracted several excellent applications from which three were selected to present their talks. The JEOL prize medal for the best oral presentation by a young scientist was awarded to Angelika Boeer (Manchester) for her talk: *Anisotropy in molecular magnetism: magnetic exchange coupling of octahedral cobalt(II) ions*. Joint runners-up were Susanna Pudollek (Freie Universität Berlin) and Bela Bode (JW Goethe Universität Frankfurt). All the student talks were of a very high calibre. The three students were also presented with cash prizes by Dr Yukio Mizuta (JEOL).

David Collison

The 32nd EPR Symposium at the Rocky Mountain Conference Snowmass, Colorado, July 19–23, 2009

The EPR symposium was held in a new venue this year, the Snowmass Conference Center in Snowmass, Colorado. A gorgeous area set deep in the Rockies with plenty of opportunities to hike and sightsee. The sessions included Advances in High Field EPR

(organized by David Budil), Spin Labeling (organized by Eric Hustedt), Spin Labeling of Nucleic Acids (organized by Vickie DeRose and Peter Qin), Metalloproteins (organized by Peter Doan and Dave Tierney), Materials and Methods (organized by Alex Angerhofer) and In Vivo EPR (organized by Howard Halpern). The presentations and discussions were lively and informative. One of the highlights of the conference again this year was a Young Investigators session which featured very well presented talks over a wide range of topics (organized by Hassane Mchaourab, EPR Chair). The poster sessions were well attended however free beer will go a long way in boosting the attendance further and adding depth to the discussions (my own personal opinion and I don't even drink beer!).

The conference was host this year to the 20th Annual General Meeting of the International EPR Society. An IES/Organizers reception was held recognizing IES Medal Winners.

The symposium also featured the yearly Lawrence Piette Memorial Lecture (sponsored by Medinox, Inc.) which this year was presented by Paul Tordo from the Université de Provence.

While we miss the Breckenridge Brewery, a new venue for late night sessions was discovered in the Conference Center Mall (2nd level) a nice small pub that offered very good wings and pitchers of beer. Those attending the late night sessions were treated to enlightening conversations about the life experiences of their mentors and colleagues.

The 52st Rocky Mountain Conference on Analytical Chemistry will take place August



1–5, 2010 at the Snowmass Conference Center and Silvertree Hotel in Snowmass, Colorado. With Hassane Mchaourab retiring, the reigns will be turned over to a new dynamic co-chair duo Glenn Millhauser and Alex Angerhofer who will put their mark on the EPR symposium. Already a major change has been announced that on most days, afternoons will be open so attendees can “explore the wonders of the Snowmass area”. Tip: a free hotel shuttle will take you to beautiful Aspen (25 min drive) and bring you back to the hotel at your convenience.

Details will be posted at www.rockychem.com/epr/index.htm.

Hope to see you there.

Hanane Koteiche

The 11th International Symposium on Spin and Magnetic Field Effects in Chemistry and Related Phenomena Brock University in St. Catharines, Ontario, Canada, August 9–14, 2009

The 11th Spin Chemistry Meeting (SCM 2009) was held at Brock University in the Niagara Region of Southern Ontario in Canada and there were a total of 48 lectures and 52 posters presented in 14 lecture sessions and two poster sessions over the five days of the conference.

The meeting attracted approximately 110 participants from 15 different countries and roughly a quarter of the attendees were graduate students, which bodes well for the

future of the field. For the SCM 2009 an effort was made to bring in a broad range of speakers in very diverse areas of research involving spin effects in chemical and biological processes.

Two very interesting lectures by Prof. Dan Weitekamp and Prof. Simon Duckett on para hydrogen induced nuclear polarization opened the meeting and were followed in the second session by a talk from Prof. Thomas Prisner on dynamic nuclear polarization at high field. The afternoon of the first day featured talks dealing with radical pairs and radical triplet pairs and much of the discussion was centered on the EPR-detected electron spin polarization in such systems.

The opening session on the second day of the conference was on bird navigation and cryptochromes and included lectures by Prof. Peter Hore and Prof. Steve Reppert. This was followed in the afternoon by two sessions on quantum effects, which included a lecture by Prof. Mike Wasielewski on teleportation in photogenerated triradicals. The second session on quantum effects sparked a lively discussion of the role of quantum coherence in photoexcited triplet states and radical pair reactions.

Prof. Osamu Sato started the third day of the conference with an extremely impressive report on his efforts towards creating materials whose magnetic properties can be controlled through external stimuli. The two sessions that followed were devoted to spin effects in materials and covered an impressive array of systems. A late addition to the

program at the end of the session was a talk on electron spin polarization transfer by Prof. Yasuhiro Kobori that was so exciting that it elicited a “Mexican wave” from some of the audience.

The final day of the meeting focused on photosynthesis and featured lectures by Prof. Klaus Möbius and Dr. Oleg Poluektov.

The poster sessions had a large number of very high quality posters mostly from the graduate students and postdoctoral fellows at the meeting.

The scientific program was complemented by several social events including an opening mixer that was generously sponsored by Dr. Henry Stronks of Bruker Canada.

The highlight of the social programme was a visit to Niagara Falls and a boat trip on the “Maid of the Mist” to experience them up close. The closing banquet was held at Hernder Estates Winery in countryside near the University and was enjoyed immensely by all.

At the business meeting of the International Spin Chemistry Committee Prof. Peter Hore graciously agreed to continue in his capacity as president and best wishes and thanks for many years of service were extended to former committee member Prof. James Norris on his retirement.

Finally, it was announced that the next Spin Chemistry will be organized by Prof. Jörg Matysik and held from the 15–20 May 2011 in Noordwijk, The Netherlands.

Art van der Est



Exciting the Next Generation of Spectroscopists

The Steppingstone MAgnetic Resonance Training (SMART) Center is a collaborative venture between Bruker BioSpin and Steppingstone School for Gifted Education (Farmington Hills, MI, USA). Its mission is to provide an authentic research experience for middle, high school, and junior college students. The SMART Center features a Bruker BioSpin ESP300 with Scientific Software Services software. Major funding comes from the Toyota Tapestry Foundation.

Over the summer of 2009, three training courses were taught in which students learned the principles of EPR spectroscopy and how to use the Bruker ESP300. The most valuable part of the course was where students brought in samples to test. Students tested several household items that have free-radical signals (burnt toast, roasted coffee, tea, some paints) which lead students to ask questions like, "I wonder if X has free radicals?" The answer to a question such as this was always "Go find out." It was the give and take of ideas between students, only oc-

asionally steered by the instructor, which defined the intellectual experience of the SMART Center. A common student comment was "In someone else's research lab, you are working on the ideas the Professor has. At the SMART Center, the Professor works on my ideas."

Do the students learn anything from this training session? This question is answered by administering both pre and post tests to test student knowledge. For example one question, "Compare and contrast T_1 and T_2 processes", none of the students could answer the question prior to the class but they could nearly all answer this question after the class. Hence, students over a wide range of ages (9 to 19) can acquire sufficient knowledge to understand and use sophisticated scientific instrumentation.

Once students completed the training course, they had access to the instrumentation to pursue their own research ideas. It is

at this critical step that the science becomes authentic – the student is now participating in a scientific discipline as an equal, not as an outsider.

Several students are pursuing research ideas. One high school student is studying free radical distribution in tea and tea leaves, a group of three are studying antioxidant properties of various beverages, and, notably, the student who was 9 years old is studying free radical formation as a result of various cooking methods.

Clearly, the opportunity for students to participate in research in which they drive the ideas is a new and powerful way to show students science as we scientists practice it. When they see science as a process that they can control, they engage in that process with enthusiasm and vigor.

Reef Morse
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POSITIONS

A DOE-funded postdoctoral position at the Argonne National Laboratory, Chemical Sciences and Engineering Division

A DOE-funded postdoctoral position is available at the Argonne National Laboratory, Chemical Sciences and Engineering Division for research work on the mechanism of solar energy conversion in natural and artificial photosynthetic assemblies. We are looking for highly motivated scientists with experience in pulsed EPR methods and data analysis. Candidates should have prior Ph.D. (within 5 years) in a discipline such as physical chemistry, biochemistry, physics or biophysics. Good written and communication skills are required. The candidate will join a team of biochemists and physical chemists in the Solar Energy Conversion Group. The project will involve the analysis of coupled structural and electron transfer dynamics in natural and artificial photosynthetic assemblies using a range of time-resolved, multi-frequency (9, 35, 140 GHz), and multi-dimensional (ENDOR, ELDOR) EPR experiments.

Argonne National Laboratory offers excellent compensation and benefits packages. Candidates should submit curriculum vitae, lists of publications/patents/honors/awards, and the names and complete mailing addresses of three professional references through the Argonne website at www.anl.gov/jobs under Job Search for Postdoctoral/Job Openings, for Requisition Number 315227 CSE. Contact Dr. Oleg Poluektov (oleg@anl.gov) for further information.

Argonne National Laboratory is a multi-program laboratory, managed by UChicago, LLC for the U.S. Department of Energy's Office of Science. Argonne is an equal opportunity employer that values diversity in its workforce. The Argonne site is located ap-

proximately 25 miles southwest of Chicago on a beautiful 1500 acre campus. For additional information, please refer to Argonne's Home Page at www.anl.gov/welcome.html.

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.

EQUIPMENT

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

Design and construction of EPR electronics

The University of Denver can supply electronic design and construction services for EPR applications. Low-noise pulse ampli-

fiers, low-noise 100 kHz preamplifiers, box-car 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

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 electromagnet. Its high resolution permits precise adjustment of the magnet's field either through the front panel keyboard or through 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.

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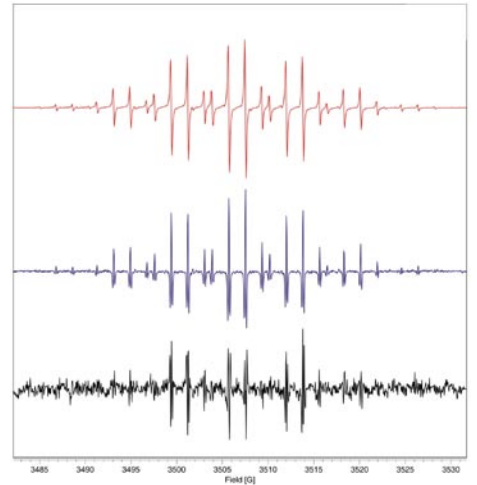
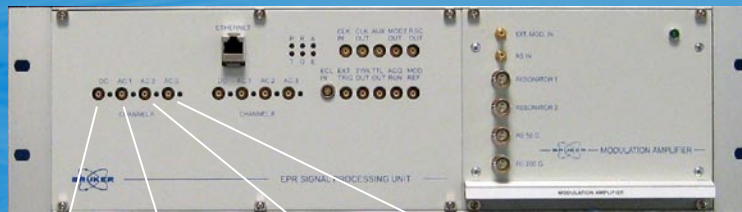
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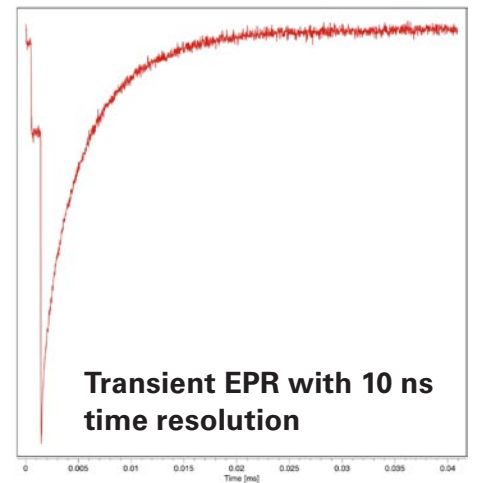
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