

EPR NEWSLETTER

Published at the Illinois EPR Research Center (IERC), Urbana, IL 61801

Volume 2, #1, September, 1989

This publication is the official newsletter of the INTERNATIONAL EPR SOCIETY. It is supported by the Society, by corporate and other donors, and by the national Centers for EPR spectroscopy in the USA. These Centers are sponsored by the Division of Research Resources of the U.S. National Institutes of Health:

National Biomedical ESR Center, Prof. James S. Hyde, Director. Medical College of Wisconsin, MACC Fund Research Center Building, 8701 Watertown Plank Road, Milwaukee, Wisconsin 53226, USA. Phone: 414/266-4000. E-Mail: felixc@medcolwi.BITNET.

Biotechnology Resource in Pulsed EPR Spectroscopy, Prof. Jack Peisach, Director. Albert Einstein College of Medicine, Department of Molecular Pharmacology, 1300 Morris Park Avenue, Bronx, New York 10461, USA. Phone: 212/430-2175. E-mail: peisach@aecom.UUCP

Illinois EPR Research Center (IERC), Profs. Harold M. Swartz and R. Linn Belford, Directors; Prof. Robert B. Clarkson, Associate Director; Prof. Peter G. Debrunner, co-Principal Investigator; additional senior staff: Profs. Peter Gast and Mark J. Nilges; University of Illinois at Urbana-Champaign, 190 Medical Sciences Building, 506 S. Mathews, Urbana, Illinois, 61801, USA. Telephone: 217/244-1186. E-mail: belford@uiucscs.BITNET. FAX: 217-244-8068.

These Centers, which were described in our first issue (Volume 1, #1), cooperate to facilitate research requiring EPR-related techniques. Prospective collaborative or service users may contact the staff at any of the Centers.

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HOW TO REACH US

To communicate concerning the EPR Newsletter, contact R. Linn Belford, Editor or Becky Gallivan, Editorial Assistant, at IERC (address above). Alternatively, contact any other IERC senior staff member or any officer of the International EPR Society. We welcome announcements, news items, notices of events, appropriate articles, and technical tips pertinent to EPR for possible publication. Your comments are invited.

EDITORIAL

With this issue you will notice some changes. Our title (formerly the Electron Spin Resonance Centers Newsletter) and masthead are changed to reflect the expanded role of this Newsletter. A new Society is being formed for the international EPR (ESR) community. This Newsletter will be its official medium of communication. Much of this issue is devoted to a discussion of the formation of the society and a call for members. I hope you will accept the invitation to become a charter member and will return the enclosed membership registration form.

You will also notice, in our title and elsewhere, the shift from the term "ESR" to "EPR". I am delighted to see a move toward use of a single name, and I support Jim Bolton's view, expressed in his commentary in this issue, that the name should be Electron Paramagnetic Resonance. My hope is that the creation of an international society for our spectroscopy will bring a move toward some sorely-needed standardization.

Linn Belford

NOTICES OF MEETINGS

International Workshop on in-vivo ESR and ESR Imaging, L'Aquila, Italy. September 13-15, 1989. For details, contact Prof. P. L. Indovina, Laboratorio delle Radiazioni, Istituto Superiore di Sanita, Viale Regina Elena 299, 00161 Roma, Italy.

International Conference on Nitroxide Radicals, Novosibirsk Akademgorodok, USSR. September 18-22, 1989. Sponsored by IUPAC and organized by the Academy of Sciences of the USSR. For details, contact Dr. V. V. Martin, Institute of Organic Chemistry, Siberian Division of the Academy of Sciences of the USSR, Novosibirsk-630090, USSR.

Twenty-first Annual Southeastern Magnetic Resonance Conference, Memphis, Tennessee, October 6-7, 1989. For details, contact Dr. Richard Petersen, Department of Chemistry, Memphis State University, Memphis, TN 38152, USA; 901-678-4416.

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Winter Meeting of the Society for Free Radical Research, "Free Radicals and Cancer," Eberhard-Karls-Universität Tübingen, Medizinische Klinik und Poliklinik, Federal Republic of Germany, December 8-9, 1989. Four scientific sessions and two workshops. For more information, contact Dr. M. R. Clemens, Medizinische Klinik, Otfried-Müller-Strasse 10, D-7400 Tübingen, F.R.G.

Eighth Annual Meeting of the Society for Magnetic Resonance Imaging, The Washington Hilton and Towers, Washington, DC, USA, February 24-28, 1990. Deadlines: Scientific Papers and Posters - October 2, 1989; Works in Progress - December 15, 1989; Applications for awards - October 2, 1989. For more information contact SMRI, 213 W. Institute Place, Suite 401, Chicago, IL 60610, USA.

Twenty-Third International Meeting of the ESR Group of the Royal Society of Chemistry, Royal Holloway and Bedford New College, Egham, Surrey, England. March 26-30, 1990. The theme will be radicals in organic and bio-organic systems. For details, contact Dr. C. C. Rowlands, Secretary, Committee of the ESR Group, School of Chemistry, Univ. of Wales, PO Box 912, Cardiff CF1 3TB, U.K.

Meeting of ESR Spectroscopists. May, 1990. Each year, a meeting of scientists interested in EPR is held in the last week of May. For details, contact Dr. Andrej Stasko, Department of Physical Chemistry, Slovak Technical University, 81237 Bratislava, Czechoslovakia.

Thirteenth International EPR Symposium at the 32d Annual Rocky Mountain Conference, Denver, CO. July 29 to August 2, 1990. For details, contact Prof. Gareth Eaton, Dept. of Chemistry, University of Denver, Denver, CO, 80208 or Prof. Sandra Eaton, Chemistry Dept., University of Colorado at Denver, 1200 Larimer Street, Denver, CO, 80204, USA.

Fifth Biennial General Meeting of The International Society for Free Radical Research, Pasadena, CA, USA, November 14 to 20, 1990. The theme will be **Oxidative Damage and Repair**. For details, contact Dr.

Kelvin P. Davies, Institute for Toxicology and Dept. of Biochemistry, University of Southern California, 1985 Zonal Ave., Los Angeles, CA, 90033, USA.

Twenty-Fourth International Meeting of the ESR Group of the Royal Society of Chemistry, Royal Agricultural College, Cirencester, Glous., England. April 15-19, 1991. The theme will be inorganic radicals and metal ions in organic and biological systems. For details, contact Dr. C. C. Rowlands, Secretary, Committee of the ESR Group, School of Chemistry, Univ. of Wales, PO Box 912, Cardiff CF1 3TB, U.K.

NOTICE OF FORMATION OF THE INTERNATIONAL EPR SOCIETY AND INVITATION

TO BECOME A CHARTER MEMBER

Following considerable discussion, including the results of a questionnaire distributed in the Electron Spin Resonance Centers Newsletter (v. 1, #2), a group of about 70 attendees at the 12th International EPR Symposium in Denver, Colorado (July, 1989) voted unanimously to form an International EPR Society and elected an Organizing Committee to carry out the steps necessary to establish it.

The aims of the Society are:

1. To stimulate the scientific development of electron paramagnetic resonance (EPR) spectroscopy.

2. To communicate information and news about EPR and its applications among its members and to serve as a clearing house on EPR among scientists in academia, government, and industry.

3. To encourage appropriate and useful application of EPR in a wide variety of fields including physical, chemical, biological, medical, agricultural, and geological systems.

4. To provide a central voice for the EPR community by promoting support for research and development utilizing EPR through interaction with other societies, government funding agencies, and international scientific organizations.

5. To stimulate educational programs on EPR and related spectroscopies through the organization of schools, workshops, and

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seminars.

The Society is to be international in scope and is to cover the entire range of disciplines that use EPR.

Some of the specific ways in which the Society will seek to achieve its goals include:

- * sponsorship of workshops;
- * establishment of a committee on instrumentation to provide recommendations on such topics as maintenance of aging Varian spectrometers and suggestions for the development of spectrometers optimized for specific classes of applications;
- * establishment of a committee to facilitate access to and knowledge of commercial and non-profit computer materials for EPR;
- * establishment of a committee on nomenclature;
- * provision of systematic input to NIH, NSF, and other government agencies throughout the world on the evaluation and support of research using EPR;
- * establishment of a newsletter as a regular vehicle for communication of information ranging from technical discussions to a calendar of upcoming meetings.

The Society will seek to work cooperatively with existing national and international magnetic resonance societies, including joint sponsorship of meetings and workshops where there is a mutual desire to do so. The Society does not intend to establish a new meeting or to establish a new journal. It will consult with existing journals to determine if there is mutual interest in some relationship that could result in enhanced coverage of EPR and a reduced subscription price for the journal for members. During the discussions about the establishment of the Society there was a strong consensus that EPR has entered a very exciting and productive stage whose full exploitation would be enhanced by having an organized body that centers on the technique. While there is no desire to dissociate from general magnetic resonance societies, it was felt that these societies inevitably will be dominated by the more numerous NMR users. Support of this viewpoint was received from government,

industrial, and academic participants.

It was agreed that the key to success of the Society will be the INVOLVEMENT of the EPR COMMUNITY in the Society. Please fill out the enclosed membership form and send it, along with the appropriate dues to the treasurer, Sandra Eaton, in the enclosed envelope. Please also encourage your colleagues and students to join.

In addition, we solicit your input on the membership of the board of directors and the officers of the Society. The Organizing Committee is just what its name suggests, and will be replaced by formally elected officers as soon as procedures can be put in place to do so. The initial membership of the Organizing Committee was selected principally from attendees at the Denver EPR Symposium to facilitate getting started. The Board of Directors will need to include a more diverse representation both geographically and by discipline. The size of the board of directors will be 25-30 and its membership, as well as the officers, will be rotated to ensure representation of all segments of the EPR community.

Your suggestions on other aspects of the Society are also requested. These can be included with your dues payment or sent to a member of the Organizing Committee. We are especially interested in promptly setting up cooperative arrangements with existing EPR (ESR) Societies and discussion groups, and seek your help in making these contacts. Mailing lists would be very helpful.

We request your membership, a prompt reply to our request for input, and your full support! Please return the enclosed membership registration form.

Submitted by the Organizing Committee:

Chair: Harold Swartz;
Vice-Chair: James Bolton;
Secretary: Gareth Eaton;
Treasurer: Sandra Eaton;
Editor: Linn Belford;
Members-at-Large: Donald Borg, Harvey Buckmaster, Jack Freed, Karl Hausser, James Hyde, Melvin Klein, Ronald Mason, Jack Peisach, John Pilbrow, Kev Salikhov, and Tadeusz Sarna.

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EPR or ESR? IT'S TIME TO RESOLVE THE SCHIZOPHRENIA!

by James R. Bolton
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London, Ontario, Canada N6A 5B7

In the 40+ years since the development of magnetic resonance spectroscopy of electrons with uncompensated angular momentum, several terms have been used for describing this form of spectroscopy. Among these, the following three have been most prominent.

Paramagnetic Resonance - This term was used widely by the group at the Clarendon Laboratory in Oxford who worked primarily with transition metal ion systems.

Electron Paramagnetic Resonance (EPR) - This modification of the Clarendon term became widely accepted in the physics and chemical physics community and was the term used for the first commercial spectrometer manufactured by Varian.

Electron Spin Resonance (ESR) - This term has been used primarily in applications to organic chemistry, biochemistry, and medicine. It is also the term used in a major textbook and monograph on ESR spectroscopy, published in 1972, of which I am one of the authors.

Custom has virtually eliminated all of the terms but EPR and ESR from general usage. Today, the terms EPR and ESR are used synonymously in the physical, chemical, biochemical, medical, agricultural, engineering, and geological literatures. This is most unfortunate, and it is quite confusing for those who do not know much about the spectroscopy.

I feel that resolution of this dichotomy is long overdue, and I urge that henceforth EPR be the standard, recommended term. I have been persuaded to this view for several reasons, including the following:

1. EPR is a more general term than ESR. There are systems with no net electron spin (e.g., O₂ in the singlet-delta state) which can be detected by EPR.

2. EPR is identified as the preferred term in a set of recommendations adopted by the International Union for Pure and Applied Chemistry (IUPAC).

3. The new International EPR Society is promoting the use of EPR and discouraging the use of ESR.

In conformity with this view, the title of the second edition (which is well underway) of our widely-used text will contain the words "Electron Paramagnetic Resonance."

I strongly encourage all scientists who now use ESR in their papers to switch promptly to using EPR instead.

ANNOUNCEMENT: A NEW JOURNAL

Title: **APPLIED MAGNETIC RESONANCE**

Editor: Prof. Kev M. Salikhov
Zavoisky Institut
Sibirsky trakt 10/7
Kazan, 420029, USSR

This Journal is targeted toward the variety of applications of magnetic resonance in physics, chemistry, biology, medicine, techniques, geochemistry, ecology, and technology. Purely theoretical papers will not be considered.

AMR will be a truly **international** journal for the publication of high-quality, original Papers and Letters to the Editor. All papers will be in English. Initially, 6 issues per year will be published. Considerable effort is being put into production quality. Guest editors will be invited for some special issues. No page charges will be assessed.

Papers can be sent to the Editor or to any member of the Editorial Board. At this time, we call for Papers for the initial issue, which we plan to publish in early 1990. Further information for those interested in contributing manuscripts can be obtained from Prof. Kev M. Salikhov.

TIPS AND TECHNIQUES

There have been several requests for publication in the EPR Newsletter of technical tips, hints, and helpful descriptions of techniques relevant to EPR work. The idea is to share with other readers technical information which you feel would be useful to others but not appropriate for formal publication in a regular journal. The Editor will be happy to consider manuscripts of this sort.

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This publication is the official newsletter of the INTERNATIONAL EPR(ESR) SOCIETY. It is supported by the Society, by corporate and other donors, and by the national Centers for EPR/ESR spectroscopy in the USA. These Centers are sponsored by the Division of Research Resources of the U.S. National Institutes of Health:

National Biomedical ESR Center, Prof. James S. Hyde, Director. Medical College of Wisconsin, MACC Fund Research Center Building, 8701 Watertown Plank Road, Milwaukee, Wisconsin 53226, USA. Phone: 414/266-4000. E-Mail: felixc@medcolwi.BITNET.

Biotechnology Resource in Pulsed EPR Spectroscopy, Prof. Jack Peisach, Director. Albert Einstein College of Medicine, Department of Molecular Pharmacology, 1300 Morris Park Avenue, Bronx, New York 10461, USA. Phone: 212/430-2175. E-mail: peisach@aecom.UUCP

Illinois EPR Research Center (IERC), Profs. Harold M. Swartz and R. Linn Belford, Directors; Prof. Robert B. Clarkson, Associate Director; Prof. Peter G. Debrunner, co-Principal Investigator; other senior staff: Prof. Mark J. Nilges and Tadeusz Walczak; University of Illinois at Urbana-Champaign, 190 Medical Sciences Building, 506 S. Mathews, Urbana, Illinois, 61801, USA. Telephone: 217/244-1186. E-mail: belford@uiucscs.BITNET or ierc@uiucvmd.BITNET. FAX: 217-244-8068.

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NOTICE: TO BE ASSURED OF RECEIVING THE EPR NEWSLETTER, PLEASE REGISTER WITH THE INTERNATIONAL EPR SOCIETY IF YOU HAVE NOT ALREADY DONE SO. PLEASE FILL OUT AND RETURN THE REGISTRATION FORM WHICH IS ENCLOSED WITH THIS ISSUE.

NOTICES OF MEETINGS

ESR Applied Metrology Workshops, Japan. Prof. Motoji Ikeya (Department of Physics, Faculty of Science, Osaka University, Toyonaka, Osaka 560, Japan) would like members of the international EPR community to know about these workshops. The first such workshop was organized in 1985 at the time of the First Symposium on ESR Dating held at Yamaguchi, Japan; cf. the Proceedings of ESR Dating and Dosimetry (Ionics, Tokyo, 1985). Five annual workshops and symposia have been held. Proceedings are available at a cost. Members are mostly physicists, geologists, and some chemists who are interested in EPR applications to geology and archaeology as well as in the development of EPR imaging (or scanning EPR microscopy) and of portable EPR spectrometers. Publications - "Applied ESR Metrology" and Newsletters with English-language titles - are available to members (dues, \$20/year). For details and Workshop schedules, contact Prof. Ikeya, whose organization wishes to exchange information with foreign EPR specialists and to encourage more involvement of geologists in the EPR community.

Meeting of ESR Spectroscopists. May, 1990. Each year, a meeting of scientists interested in EPR is held in the last week of May. For details, contact Dr. Andres Stasko, Department of Physical Chemistry, Slovak Technical University, 81237 Bratislava, Czechoslovakia.

Gordon Conference on Radical Ions, Brewster Academy, Wolfeboro, New Hampshire, USA. June 25 to 29, 1990. Gerhard L. Closs, Chair; Philip H. Rieger, Vice-Chair. Participants will include Heinz Roth, Joseph Dinnocenzo, David Griller, Paul Dowd, Addy Pross, Weston Bordon, Jack Fajer, Marion Thurnauer, Gary Brudvig, Dewey Holten, Ian Gould, Barbara Warren, Wolfgang Lubitz, Haim Levanon, Marye Anne Fox, Paul Krusic, Neil Connelly, William Trogler, Glen Russell, Yu Molin, Kev Salikhov, Lowell Kispert, Gerd Kothe, Anthony Howard, Danny Meisel, Philip Rieger, O. A. Anisimov, Laren Tolbert, Barney Ellison, Joseph Grabowsky, and Paul Kebarle. In addition, there will be a poster session and a few short talks. Attendance is limited. For details, contact Prof. Philip Rieger, Department of Chemistry, Brown University, Providence, Rhode Island 02912, USA.

Gordon Conference on Magnetic Resonance in Biology and Medicine, Tilton School. July 16-20, 1990. Robert G. Bryant, Chair; Betty J. Gaffney, Vice-

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Chair. Participants will include G. Drobney, P. Lauterbur, L. Jelinski, A. Johnson, T. Brown, J. Freed, G. Glover, R. P. Mason, B. Balaban, M. Henkelman, J. Ackerman, B. R. Rosen, I. R. Young, D. LeBihan, M. Tweedle, J. Gore, J. Kowalewski, R. Lauffer, T. Dixon, C. Springer, J. Ingwall, T. Schleich, M. Klein, R. Griffin, H. Thomann, K. Ugurbill, R. Hurd, J. S. Hyde, J. Glickson, L. Sillerud, H. Halpern, and J. Saunders. Attendance is limited; inquire immediately. For details or application forms, contact Dr. Alexander M. Cruickshank, Director, Gordon Research Conferences, Gordon Research Center, University of Rhode Island, Kingston, RI, USA. Phone 401-783-4011 or FAX 401-783-7644. (From June 11 - August 27, Dr. Cruickshank's address is Colby-Sawyer College, New London, NH 03257, USA; 606-526-2870; FAX 603-526-4717.)

Workshop on Special Topics in Medical Magnetic Resonance sponsored by the International Union of Pure and Applied Biophysics with the National Research Council of Canada and the Society for Magnetic Resonance in Medicine, Whistler, BC, Canada, July 23-27, 1990. Co-Chaired by Ian C. P. Smith and Joanne S. Ingwall. On July 26 there will be a session on ESR in Medicine; speakers will include J. Hyde, E. Janzen, R. Mason, and H. Swartz. For details, contact L. Forget, National Research Council, Ottawa, Ontario K1A 0R6, CANADA; Tel: 613-993-9009; FAX: 613-957-9828.

Thirteenth International EPR Symposium at the 32d Annual Rocky Mountain Conference, Denver, CO, July 29 to August 2, 1990. At this meeting, Dr. Hans Thomann is organizing a session that will be held jointly as an NMR and EPR Session; some of the speakers will be Bob Griffin (high frequency DNP); Jacob Schaefer (DNP of polymer interfaces); Robert Wind (New Techniques in DNP); Bruce Robinson (Advances in DNP Theory); Arthur Schweiger (pulsed ENDOR, title to be announced); Hans Thomann (pulsed ENDOR: new techniques and metalloprotein studies); Peter Hofer (Developments in pulsed ENDOR: Applications to Organic Radicals).

Dr. Ronald P. Mason is organizing a session on "In vivo Detection of Free Radical Metabolites". The major speakers will be: E. Janzen (Guelph), P. McCay (Oklahoma Medical Research Foundation), H. Connor (Kentucky Wesleyan), T. Bray (Guelph), K. Maples (Lovelace Research Institute), R. Mason (National Institute of Environmental Health).

Plenary lecturers will be Richard Cammack (London - EPR, ENDOR, and ESEEM Spectroscopy of Ni(III) Hydrogenases) and R. Sagdeev (Novosibirsk - Stimulated Nuclear Polarization Study of Short-lived Radical Species).

The meeting will also include contributed papers, poster sessions, and a **business meeting of the International EPR Society (5-5:30 PM, Monday, July 30)**. For further details, contact Prof. Gareth Eaton or Prof. Sandra Eaton, Dept. of Chemistry, University of

Denver, Denver, CO, 80208.

Fourteenth International Conference on Magnetic Resonance in Biological Systems, University of Warwick, England, September 9 to 14, 1990. The scientific program will consist of lectures and poster sessions. Major topics will include: *Protein and peptide structure and dynamics, 3D structure from 2D NMR, Metalloproteins and electron transfer, Nucleic acids and protein-nucleic acid interactions, Biological membranes, Magnetic resonance imaging, NMR in living systems, and Techniques*. A proportion of the lecturers in parallel sessions will be chosen from the submitted poster abstracts. Facilities will be available for specialized workshops; anyone interested in organizing one of these is urged to contact Prof. Roberts. For details contact Prof. Gordon C. K. Roberts, Biological NMR Centre, University of Leicester, P.O. Box 138, Medical Sciences Building, University Road, Leicester LE1 9HN, UK.

Fifth Biennial General Meeting of The International Society for Free Radical Research, Pasadena, CA, USA, November 14 to 20, 1990. The theme will be **Oxidative Damage and Repair**. For details, contact Dr. Kelvin P. Davies, Institute for Toxicology and Dept. of Biochemistry, University of Southern California, 1985 Zonal Ave., Los Angeles, CA, 90033, USA.

Twenty-Fourth International Meeting of the ESR Group of the Royal Society of Chemistry, Royal Agricultural College, Cirencester, Glou., England, April 15-19, 1991. The theme will be inorganic radicals and metal ions in organic and biological systems. For details, contact Dr. C. C. Rowlands, Secretary, Committee of the ESR Group, School of Chemistry, Univ. of Wales, PO Box 912, Cardiff CF1 3TB, U.K.

The ESR Group of the Royal Society of Chemistry and the ESR Group in Italy expect to hold a joint meeting in Italy during September, 1991. A more complete announcement will appear in a future issue.

International Workshop on Electron Spin Echo Spectroscopy, Novosibirsk, USSR, September 25-28, 1991. The workshop will deal with problems and applications of ESE spectroscopy. For details, contact Dr. S. A. Dikanov or Dr. A. V. Astashkin, Institute of Chemical Kinetics and Combustion, Novosibirsk, 630090, USSR.

Third International Symposium on ESR Dosimetry, National Institute of Standards and Technology, Gaithersburg, Maryland, USA, October 14-18, 1991. For details, contact Dr. Marc F. Desrosiers, NIST, Building 245, Room C214, Gaithersburg, MD, 20889, USA.

EDITORIAL

EPR, ESR, EMR, or what? In the previous issue we recommended the use of a single term to designate our

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science and reported that the organizers of the new International EPR Society had settled on "Electron Paramagnetic Resonance" rather than "Electron Spin Resonance." The organizers thought that a single name would be best, but were not unanimous in their personal preferences regarding which it should be. We printed a statement by Prof. James Bolton urging that "EPR" be adopted as the standard term. We expected some reactions and have not been disappointed. There have been praise, complaints, questions, and alternative suggestions. In the Letters to the Editor, Prof. Martyn Symons offers a response to Prof. Bolton calling for the shift to the term EPR to be encouraged but not forced.

We have been asked if the International EPR Society intends to include both ferromagnetic resonance and antiferromagnetic (or spin-wave) resonance. Yes, these areas are certainly to be included in the scope of the Society and of this Newsletter.

A few colleagues suggest that we adopt "EMR," "Electronic Magnetic Resonance," the counterpart of "NMR," "Nuclear Magnetic Resonance," as an alternative to "EPR" or "ESR". This idea makes sense; it would be very nice indeed if the term EMR had been widely adopted decades ago. Is it too late to utterly defy custom and standardize on a term which has been used only occasionally over the past 45 years?

As the EPR Newsletter is just getting started as the news medium for the International EPR Society, we again invite readers to contribute material which may be of interest to others in the EPR community. The "Tips and Techniques" section started with this issue is an example. We shall also publish notices of job openings in the field of EPR and are willing to try an equipment exchange section, where those who wish to sell or give away surplus equipment of interest to EPR spectroscopists may place announcements. Finally, we urge readers to provide information on published proceedings of meetings; we shall publish such information in the "Notices of Meetings" and "Notices of Books and Conference Proceedings" sections.

Linn Belford

NOTICES OF BOOKS AND CONFERENCE PROCEEDINGS

William Weltner, Jr.'s book *Magnetic Atoms and Molecules* has been reprinted in paperback by Dover, ISBN 66140-7, \$9.95. Applied Radiation and Isotopes volume 40 no. 10-12, 1989 is the proceedings of the

ESR Dosimetry and Applications conference that was held in Munich in October 1988. Also, *Pure and Applied Chemistry* volume 62, no. 2, 1990 is the proceedings of the Nitroxide Radicals Meeting that was held in Novosibirsk in September 1989.

REPORT ON FORMATION OF THE INTERNATIONAL EPR SOCIETY

In general, things seem to be moving along very well. There has been a remarkably strong and positive response to the formation of the Society and we now have approximately 400 membership applications. Although size of membership, in itself, should not be a criterion for success, in this instance I believe that the effectiveness and usefulness of our Society will be enhanced greatly by having a large and representative membership. Therefore, we should continue and expand our efforts to get as many members signed up as possible; it now seems reasonable to have a goal of 1000 charter members.

As most of you probably know, at the 12th International EPR Symposium in Denver in August 1989, there was a formal vote of approval of formation of the Society. The participants in the meeting at Denver indicated that there was a preference for the initial responsible group to be termed an Organizing Committee rather than an initial Board of Trustees and officers and we have proceeded accordingly. The composition of the Organizing Committee is as follows:

Chair: Harold Swartz;

Vice-Chair: James Bolton;

Secretary: Gareth Eaton;

Treasurer: Sandra Eaton;

Editor: Linn Belford;

Members-at-Large: Donald Borg, Harvey Buckmaster, Jack Freed, Karl Hausser, James Hyde, Melvin Klein, Ronald Mason, Jack Peisach, John Pilbrow, Kev Salikhov, and Tadeusz Sarna.

The information on the formation of the Society, its aims and general organization was distributed to approximately 2000 people via the mailing list established with the EPR Newsletter. The current list of persons applying for membership has come principally in response to that mailing plus the efforts of individuals, official and unofficial, in various countries.

In the course of the development of the Society, there has been considerable discussion with members and officers of *existing* regional EPR/ESR societies.

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There is a strong interest in finding ways to have the International Society and Regional Societies complement each other rather than compete. A related issue is the development of regional organizing committees, and perhaps *new* regional societies. This seems desirable in view of the complex nature of the EPR community and the fact that some of the countries with high interest in these techniques have soft currencies. The aim is to facilitate the development of the International Society by designating regional committees who will solicit members for the International Society, facilitate communications between the Society and the members, and where appropriate collect the dues in order to minimize problems and expense in converting currencies.

As a result of these discussions, we have prepared guidelines for (1) the relationship between the International Society and Regional Societies and (2) the formation of Regional Committees. These are available on request to those who are interested.

The organizing committee has the following agenda, with an aim of completing the tasks by approximately June 1, 1990:

1. Prepare a set of bylaws and have them approved by the membership.
2. Nominate a slate of officers and members of the Board of Trustees and submit these to the membership for approval.
3. Complete the phase of charter membership, aiming at achieving as high and as diverse of a membership as is possible.
4. Ratify and implement the guidelines for interactions with regional societies and the operations of regional organizing committees.
5. Establish and make operational committees in the following areas: a) nominating; b) computers; c) nomenclature.
6. Take steps to incorporate the Society as a legally-constituted nonprofit scientific organization.

It is gratifying that some industrial support already has been promised. For example, Bruker has pledged to underwrite legal and related startup costs.

In order to deal with the potentially complex questions on membership fees, relations of these to other societies, etc., we have tentatively adopted a policy in which there is an initial charter membership fee of \$25 or the equivalent in other currencies. Presumably, this fee will apply to those who join the Society subsequently, although we hope that most of them will

pay it in time to become charter members. The funds generated by the initial membership fees should be sufficient to run the Society over the near term, but within the next 6-12 months we will probably need to establish annual dues. Presumably we will establish the dues on the basis of the observed and expected expenses of running the Society. If we are successful in obtaining strong financial support from industry, we will be able to keep the annual dues at a very low rate, thus enhancing the probability of having a wide membership in an active and useful Society.

The two tasks that require active and immediate actions by members and potential members of the Society are 1) the solicitation of new members to the Society; 2) recommendations for the officers of the Society and members of the Board of Trustees who are to be elected. Our experience has indicated already that the most effective way of obtaining additional members of the Society is contact by people who are well known and well regarded by the potential members. Therefore, you will be particularly effective if you will personally solicit members in your own and nearby countries in all fields and worldwide in your own field. Remember, we are especially interested in having our membership include people from all disciplines that use any of the types of EPR techniques. The most convincing arguments you can make for joining the Society would include the facilitation of scientific exchanges by the Society and the influence that a large and active Society can have in improving industrial and governmental support for EPR.

Harold M. Swartz
Chair, Organizing Committee for
the International EPR Society

LETTERS TO THE EDITOR

Sir:

Please print the following response to Prof. Bolton's discussion on EPR vs ESR:

SPERS

(Society for the Protection
of ESR Spectroscopists)
Reply to James R. Bolton

Dear Jim,

What's in a name? I'm an ESR spectroscopist and have been for some 35 years. I'm really too old to

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change now! If there were some strong incentive, maybe I would sometimes remember to write "EPR," not "ESR," but it would take time and effort. As it is, I don't see how that would profit me. So unless some pressure group insists (how?) I will remain an ESR spectroscopist!

I'm actually attached to the name, odd though that may sound. In the meantime, by all means encourage the change, but please don't try to enforce it. Variety is the spice of life.

Martyn C. R. Symons
Department of Chemistry
The University
Leicester LE1 7RH England

Sir:

Your readers may be interested in a question which concerns us. The question is, can the newest generation of commercial X-band EPR spectrometers give substantially improved sensitivity for lossy samples? If so, how should these spectrometers be used to realize their best potential for the aqueous (i.e., lossy) samples? I enclose for you to print with this letter, the following material partly abstracted from our poster (A. M. Bobst and E. V. Bobst, "A Comparative Sensitivity Study Between the Varian and Bruker TM Cavities on a Varian E-104 and a Bruker ESP 300 Spectrometer," International EPR Symposium, Denver, August, 1989):

A large flat cell (Wilmad, ~55x15x2 mm) filled with 2×10^{-7} M DUTA (a spin labeled nucleoside) in aqueous solution was properly positioned in a Varian TM cavity to measure its ESR signal with a Varian E-104 spectrometer. This experiment was repeated with the same flat cell containing the same solution using a Bruker TM cavity attached to a new Bruker ESP 300 spectrometer. The calibrations of modulation amplitude and time constant were verified for both instruments and met the manufacturers' specifications. Power saturation studies gave similar results for the DUTA sample with both instruments. The signal-to-noise (S/N) ratio for the DUTA sample was 18 with the Bruker instrument, whereas a value of 22 was determined with the Varian machine. On the other hand, a comparative sensitivity study with the Bruker weak pitch clearly established the excellent performance of the new Bruker instrument (Bruker, S/N=471;

Varian, S/N=32). Thus, a Varian E-104/TM cavity combination seems to perform at least as well as the equivalent Bruker setup with flat cells containing aqueous nitroxide solutions, even though weak pitch results suggest a very different finding, with Bruker outperforming Varian by over 1000%.

Dr. Ronald P. Mason (National Institute of Environmental Health Sciences, Research Triangle Park, NC, USA) sent the following relevant data collected by Dr. Walee Chamulitrat (August, 1989):

"The sensitivities of six spectrometers using a TM_{110} cavity and a 17-mm flat cell were compared on the same day. The middle peak of a stable nitroxide signal from 1×10^{-5} M 4-AMINO TEMPO was optimized in phase, modulation amplitude, and power. The same signal at its optimized conditions (with 0.1 sec time constant, 2-minute scan time (or equivalent) and 20 G scan range, and with at least 3 scans of each spectrometer) was recorded by using 1×10^{-7} M 4-AMINO TEMPO. The signal-to-noise ratio was measured with the following results:

	Normalized S/N (S.D.)
1. ER 200	100 (± 14)
2. E-109 (Bldg. 10)	91 (± 16)
3. E-109 (Bldg. 4, KTK)	60 (± 13)
4. E-109 (Bldg. 4, BS)	54 (± 1)
5. E-104	45 (± 5)
6. ESP 300 with original klystron*	45 (± 5)

*(Later, with new klystron, S/N(ESP 300) \approx 100) "

In conclusion, the computer-aided Bruker ESP 300 EPR instruments offer significant advantages in terms of instrument operation and data handling, and the instrument gives impressive S/N ratios for the low-loss weak pitch. Even so, the data from our laboratory and from others seem to suggest that in some respects the newest commercially available EPR instruments with TM cavity and flat cell may afford life scientists aqueous-sample sensitivity comparable to that which they were accustomed to having with the older spectrometers such as the Varian setup with Varian TM cavity. We do not know whether the performance reported here for aqueous solutions in large flat cells is due to some detail of recently made TM cavities or some inherent characteristic of lossy samples which prevents the improvements in the new instruments from having much effect on S/N ratio. Perhaps it would be advantageous to use the new spectrometers in a different way than one is accustomed to when one

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needs higher sensitivity for aqueous samples with low radical concentrations.

If our colleagues anywhere have useful information bearing on this problem, please share it with us. We are pleased to report that the scientists at Bruker are carefully investigating our concerns, and we hope for a timely resolution.

Albert M. Bobst
Department of Chemistry
University of Cincinnati
Cincinnati, OH 45221-0172, USA

Bruker responds:

I have found some reasonable answers to the questions posed by Prof. Bobst and will address sensitivity for low-loss and lossy samples in the next issue.

Ralph F. Weber, EPR Division
Bruker Instruments, Inc.
Billerica, MA 01821, USA

SECOND ANNOUNCEMENT: A NEW JOURNAL

Title: **APPLIED MAGNETIC RESONANCE**

Editor: Prof. Kev M. Salikhov
Zavoisky Institut, Sibirsky trakt 10/7
Kazan, 420029, USSR

This Journal is targeted toward the variety of applications of magnetic resonance in physics, chemistry, biology, medicine, techniques, geochemistry, ecology, and technology. Purely theoretical papers will not be considered.

AMR will be a truly international journal for the publication of high-quality, original Papers and Letters to the Editor. All papers will be in English. Initially, 6 issues per year will be published. Considerable effort is being put into production quality. Guest editors will be invited for some special issues. No page charges will be assessed.

Papers can be sent to the Editor or to any member of the Editorial Board. At this time, we call for Papers for the initial issue, which we plan to publish in early 1990. Further information for those interested in contributing manuscripts can be obtained from Prof. Kev M. Salikhov.

TIPS AND TECHNIQUES

As stated in the previous issue, there have been several requests for publication in the EPR Newsletter of technical tips, hints, and helpful descriptions of techniques relevant to EPR work. The idea is to share

with other readers technical information which you feel would be useful to others but not appropriate for formal publication in a regular journal. Here are two examples, which The Editor hopes will stimulate many more such contributions:

Hint for EPR and ENDOR of Frozen Aqueous Samples:

In the group of George Feher at UCSD we have found that for doing EPR on frozen aqueous samples, the type 705PQ EPR tubes (3mm OD x 2 mm ID), made by Wilmad Glass (Buena, NJ) are very useful for samples to be run in either a 3 mm ID loop-gap 9 Ghz spectrometer or a standard 35 Ghz TE012 cavity. For the best ENDOR results, rapid freezing is generally used. To prevent occasional sample tube cracking and loss of precious samples we insert a long piece of #28 or #30 teflon spaghetti tubing (OD = 0.7 mm) to take up the mechanical stress of water while freezing or thawing. A drop of high vacuum silicone grease is sometimes put in the lower end of the spaghetti before insertion into the sample tube to prevent wicking of the sample. The presence of the tubing reduces the inside cross sectional area by only about 15 %, so has a minimal effect on the signal amplitude.

Roger A. Isaacson
Physics Department
Univ. of California at San Diego

Alternatives to Commercial Flat Cells for Lossy Samples:

The commercial flat cells for lossy samples are expensive and fragile. In addition they require a large volume of material, some of which is not located in the active region of the cavity. We have found an inexpensive alternative that works well for many applications and has a larger internal volume than the commonly used melting point capillaries.

Vitro Dynamics (114 Beach St, Rockaway, N. J. 07866 USA) sells rectangular cross section pyrex tubing in 4 to 5 cm lengths with path lengths in the short direction of 0.05, 0.10, 0.20, 0.30 and 0.40 mm and widths of 3 mm to 6 mm. The product is called Microslides. The 0.3 mm by 3 mm tubing is catalog number 3530 and the 0.4 x 4 mm tubing is catalog number 2540. The cost is about \$0.20 per piece. Depending upon your budget, that may mean disposable or worth washing!

The tubing is pyrex but the walls are thin enough

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that we have not observed significant interference from EPR signals near $g = 2$ for samples of the usual concentrations. However, there is a substantial iron signal at $g = 4.3$. The tubing is open at both ends so the tubes can be filled by capillary action. We have found that parafilm or critoseal can be used to seal the end. Note that if you use critoseal, the seal must be positioned below the active volume of the cavity since the critoseal has a Mn(II) EPR signal.

We support the microslides in a cylindrical teflon holder that fits snugly inside the cavity and has a groove to hold the microslide vertical. The teflon holder has the added advantage that it concentrates the microwaves, which gives a higher B1 at the sample for a given setting of the bridge attenuator than is obtained in the absence of the teflon.

We reported the use of microslides in *Anal. Chem.* 49, 1277 (1977). A recent article by Pedersen and Cox (*J. Magn. Reson.* 77, 369 (1988)) looked at rectangular capillaries with two internal dimensions and also noted the advantages over round capillaries. They name additional suppliers of rectangular tubing. We expect that other people who work with lossy samples will also find this technique useful.

Gareth R. Eaton and Sandra S. Eaton
Department of Chemistry
University of Denver
Denver, CO 80208

NEWS FROM THE CENTERS

From the National Biomedical ESR Center in Milwaukee:

COLLECTIONS OF PAPERS AVAILABLE

Twenty-five papers by Center personnel on Saturation Recovery EPR Spectroscopy have been assembled into a collection (duplex photocopied and stapled). This collection can be obtained without charge by writing to Christopher Felix, Ph.D., National Biomedical ESR Center, Medical College of Wisconsin, 8701 W. Watertown Plank Rd., Milwaukee, WI 53226, USA.

Availability of a collection of papers on Loop-Gap Resonators was announced previously in the *EPR Newsletter*. Copies are still available.

The Center anticipates making other compilations available on topics such as Multifrequency EPR, Spin-Label Oximetry, ELDOR, etc. A Research Resource

has a formal responsibility for dissemination of developments at the Resource. The Milwaukee Center is currently exploring this mode of dissemination. Your suggestions or comments would be appreciated.

TRAINING IN EPR SPECTROSCOPY - The National Biomedical ESR Center offers a 2-week individualized intense training program. The program, sponsored by the National Institutes of Health, is designed to provide hands-on opportunities in many advanced ESR/EPR techniques for graduate students and faculty members who have some previous experience working with EPR. The award includes travel expenses up to \$500(US). To apply, send a letter and a one-page research plan. In addition, a student applicant should include a letter from the graduate advisor. Address applications to Dr. Ching-San Lai, National Biomedical ESR Center, Medical College of Wisconsin, 8701 Watertown Plank Road, Milwaukee, WI 53226; Telephone 414-266-4051.

From the IERC in Urbana:

W-BAND EPR SPECTROSCOPY - The IERC announces that its W-band (95 Ghz) EPR spectrometer is in operation and available for experiments by outside users. Worldwide, there are only a few very-high-frequency (VHF) EPR spectrometers in operation; most of these have been special-purpose instruments. In 1983, Prof. Ya. S. Lebedev and associates in the Soviet Union reviewed their pioneering work in D-band (~140 Ghz) spectroscopy [O. Ya. Grinberg; A. A. Dubinskii; Ya. S. Lebedev, *Russ. Chem. Rev.* (English translation), 52, 850-865 (1983)]. We recommend this review (and new reviews by Lebedev, to appear) for a good overall introduction to the purposes, advantages, and limitations of VHF EPR spectroscopy and for some examples of its use. Belford *et al.* selectively reviewed high-frequency EPR in the overall context of multifrequency EPR strategies [R. L. Belford; R. B. Clarkson; J. B. Cornelius; M. D. Timken, K. S. Rothenberger; M. J. Nilges, in *Electronic Magnetic Resonance of the Solid State*, CSC Symp. Ser. 1, J. Weil, Ed., 21-43 (1987)]. Freed and coworkers [D. E. Budil; K. A. Earle; W. B. Lynch; J. H. Freed, in *Advanced EPR*, A. J. Hoff, Ed., Elsevier, Amsterdam, 307-340 (1989)] describe EPR spectroscopy at 240 GHz and cite other high-frequency EPR systems including that of Klaus Möbius and coworkers in Berlin. VHF-EPR spectroscopy offers many technical

benefits, some of which cannot be accomplished in any other way. Among these are the following: The large magnetic field separates different kinds of physical interactions in molecules, thus (1) adding a great deal of information to improve interpretations of complicated spectra (i.e., adding critical information within an overall multifrequency strategy), (2) dramatically enhancing g-resolution of similar species (allowing spectral separation of sites and components in mixtures that have heretofore appeared to have only one species), (3) enhancing resolution of g anisotropies so as to provide detailed single-crystal-like structural information from disordered materials, (4) simplifying some interpretations because of dominance of Zeeman terms (e.g., in cases of many metal complexes or radicals where the various matrices of the spin hamiltonian have noncoincident axis systems, turning points tend to be noncanonical and interpretations difficult except at very high magnetic fields, where canonical orientations are largely those of the g matrix), (5) enhancing angle selection in double resonance, and (6) probing inhomogeneous (strain) broadening. The high frequency enables (7) spanning of zero-field splittings in high-spin systems (eg., many important metalloproteins in which the metal site has heretofore been difficult or impossible to characterize), (8) extending the study of molecular motions, such as those in membranes, and frequency dependencies of relaxation, into new time regimes, and (9) studying very small samples (because of the higher intrinsic transition intensities and short wavelengths).

In its current configuration, the W-band (~95 GHz) VHF-EPR spectrometer which has been built at the IERC is of a homodyne design having a tunable end-coupled TE_{013} or TE_{012} cylindrical cavity, a varactor-tuned Gunn oscillator with 35 Mw power output (with a 400 mW Klystron available for applications requiring higher power and lower phase noise), a bridge with reference arm, and a tunable Schottky diode detector. The source is either frequency-locked to a reference oscillator in phase-lock loop or locked to the sample cavity by frequency modulation and phase-sensitive detection with feedback. Field modulation with phase-sensitive signal detection is included in the spectrometer system, which incorporates a Varian XL-200 superconducting magnet (maximum field 4.7 Tesla). For acquiring spectra of free radicals, the field is swept with a separate room-temperature solenoid while the superconducting system stays in persistent

mode. This mode of operation provides a very stable, reproducible magnetic field sweep and very low liquid helium consumption. The spectrometer is interfaced to an IBM PC/AT computer for field scan and spectral data acquisition through an A/D board. A 100 GHz frequency meter, a tracking teslameter, and the lock-in amplifier are controlled through an IEEE-488 bus.

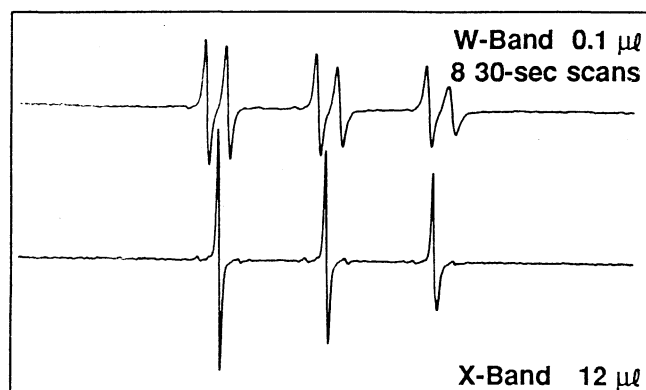


Figure 1 X- and W-band spectra of an aqueous nitroxide mixture (0.1 mM TEMPONE + ~0.1 mM d-PCA). W-band: microwave frequency, 94.4971 GHz; field range, 0.00929T centered at 3.36506T.

The spectrometer has been tested with several liquid (aqueous and nonaqueous) and solid samples. Typical sample sizes are 0.1-0.8 mm diam \times 6 mm length (50 nl to 3 μ l). The study with this spectrometer of a variety of whole coals and separated coal macerals has demonstrated the utility of W-band EPR in resolving overlapping spectra of organic radicals having only slightly different g-factors or slight g anisotropy in solids [cf. R. B. Clarkson, W. Wang, M. J. Nilges, & R. L. Belford, "Influence of Organic Sulfur in Very High Frequency EPR of Coal," in *Processing and Utilization of High-Sulfur Coals III*, R. Markusewski & T. D. Wheelock, Eds., Elsevier, New York, 67-79 (1990), which includes a diagram of the instrument]. Separation of similar radical constituents is exemplified in the spectrum of two nitroxides in aqueous solution, Figure 1. We have acquired W-band spectra of several melanin species prepared at a variety of pH values, as illustrated in Figure 2. Most of these have EPR spectra that are virtually indistinguishable at X-band, and differ only slightly at Q-band, but are quite different at W-band. Species differentiation and resolution of anisotropy become relatively easy at this frequency.

Finally, definitive resolution of rhombic anisotropy in coordinated Cu(II) and of ~10 ppm orientational g variation in small LiPC crystals have been demonstrated.

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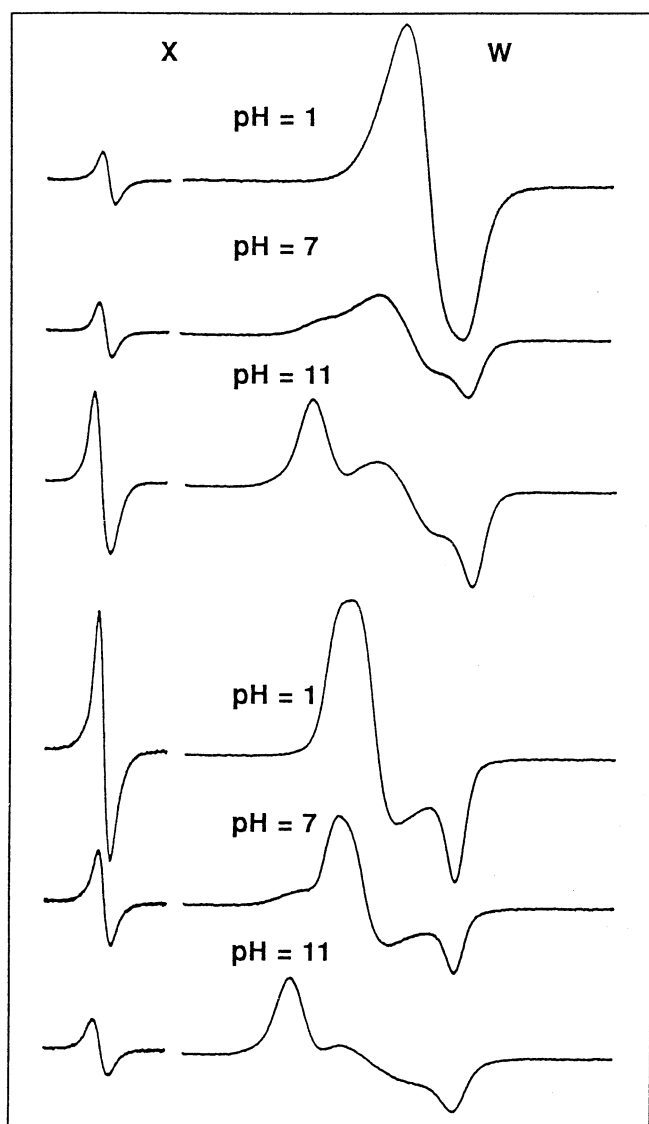


Figure 2. X-band (left) and W-band (right) spectra of dopa-based melanin (top 3 traces) and a melanin-like pigment formed from minocycline (lower 3 traces). W-band: $\nu = 94.16$ GHz; field range = 0.0140T centered at 3.3573T.

Those who are interested in exploring use of the W-band spectrometer are invited to contact any of the IERC personnel for a discussion of feasibility. Many experiments can be done now, and more will be possible as the instrument is upgraded.

EPR COMPUTATIONAL SOFTWARE - We need your help. Over the years, we have distributed without charge many copies, and several versions, of software for EPR simulations and computations. We know also

that many copies now in use have been passed on from the original recipients. The IERC staff is engaged in a project to systematically improve, standardize, document, and package some of this software. In this connection, we are attempting to locate all users and survey them regarding their experiences with our software and their needs. If you have any of our software, *whether or not you have obtained it directly from us*, we need your help. Just contact us, with your address, and we will send you a questionnaire. All those who help in this effort will be sent the newer and better-documented versions which we expect to produce in this project.

UPDATES, NOTICES, AND REQUESTS

EPR Standards Project Update

by Robert B. Clarkson
Illinois EPR Research Center
University of Illinois
Box 61 NL, 505 S. Mathews
Urbana, IL 61801, USA

On December 7-8, 1989, a series of meetings was held at the National Institute for Standards and Technology (NIST), Gaithersburg, MD, to begin the development of standard samples for EPR spectroscopy. The sessions were sponsored by NIST and the Greater Washington Area EPR Discussion Group, and were attended by over fifty scientists. On the first afternoon, presentations by members of the NIST EPR Standards Committee were followed by a general discussion of the current and future needs for standards. On the second day, the committee reconvened for a working session whose goal was the development of a plan for future work.

The December workshop had been preceded by a survey of needs and uses for EPR Standard Reference Materials that was sent to the scientists (ca. 2000) who receive the EPR Newsletter. Dr. Marc F. Desrosiers (NIST) and the Illinois EPR Research Center (IERC) collaborated on this initial questionnaire. Response to the mailing was remarkable both in the high level of interest that was expressed and in the range of needs that were identified, convincing us that work on the project should begin as quickly as possible. At the request of NIST, Bob Clarkson (IERC) enlisted the

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participation of six EPR scientists from private industry and academic research to constitute a working committee for the development of EPR standard materials, and this group had its first working sessions during the December meeting. Committee members include: R. Linn Belford and Robert B. Clarkson (IERC, University of Illinois at Urbana), Ira Goldberg (Rockwell International), Arthur H. Heiss (Bruker Instruments), James S. Hyde (National Biomedical ESR Center, Medical College of Wisconsin), Roger A. Isaacson (University of California at San Diego), and Jack Peisach (Research Resource in Pulsed EPR Spectroscopy, Albert Einstein College of Medicine). James R. Bolton also has agreed to assist the committee in its work. Several important facts have emerged as a result of these efforts.

It is now very clear that there is a great need for spin concentration standards. All fields of science that employ EPR seem agreed on this point. These standards should be in the form of certified Standard Reference Materials (SRM's). They should be stable, reasonably easy to use, and be available in several concentrations. They also may do additional service as calibrated g-standards, and perhaps even as microwave saturation standards. The standards should be supplied together with clear and complete documentation describing their proper use. Several different carbon-based materials were discussed as potential standards at the December meetings, and it seems likely that a suitable material can be developed in a reasonable amount of time. Other standards for g-value calibration, magnetic field calibration, and spin relaxation measurements also were discussed, and it was decided to address their development after the spin concentration standard has been completed. It was felt that at least some of these additional standard materials might be too reactive to develop as SRM-type materials, but that they could be supplied as pre-formulated kits which scientists could use to create the standard material as needed in their individual laboratories. In all cases of EPR standards, the committee felt strongly that excellent documentation on the proper use of the materials was essential; development of this documentation will constitute an important component of the work.

The next steps in this project involve laboratory work

to develop and test materials suitable for a spin concentration standard. Members of the EPR Standards Committee will continue to work in collaboration with NIST scientists to produce a set of recommendations on the first NIST standard for EPR. At that time, the characteristics of the proposed sample will be described in this newsletter, in order to solicit recommendations from the scientific community. Only after a thorough discussion will the recommendations of the Committee become final, and be sent to the Office of Standard Reference Materials at NIST for manufacture and certification of SRM's for EPR spectroscopy, which then will be offered for sale by NIST.

NOTICE -- EPR Service Facility

Dr. Sandip K. Sur announces that the Chemistry Research and Instrument Services at the University of Oregon has NMR instrumentation (NT-360 and QE-300) and has acquired a new Bruker ESP-300 EPR spectrometer, all of which are made available on a fee basis to outside investigators who do not have local access to their own facilities. For information, contact Dr. Sur at the Chemistry Department, University of Oregon, Eugene, OR 97403-1253, USA, Telephone 503-686-4601; FAX 503-686-4643.

POSITIONS OPEN

Postdoctoral fellow in the field of EPR spectroscopy of paramagnetic compounds at surfaces. Experience in EPR required. Salary, ca. \$30,000 per year. Prof. A. von Zelewsky, Institut de Chimie Inorganique et Analytique, Université de Fribourg Suisse, Pérolles, CH-1700 Fribourg, Switzerland. Phone 037/82 64 22.

EPR Applications Scientist. Medical Advances, a growing company dedicated to the development of EPR-related instrumentation for research and commercial applications, is seeking an EPR Applications Scientist. The applicants should possess EPR instrumentation experience and strong interest in defining and contributing technically to new product and market development. Contact Bill Zabriskie, CEO. Address: 10431 W. Watertown Plank Rd., P.O. Box 26425, Milwaukee, WI, USA. Phone: (414) 258-3808.

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This publication is the official newsletter of the INTERNATIONAL EPR(ESR) SOCIETY. It is supported by the Society, by corporate and other donors, and by the national Centers for EPR/ESR spectroscopy in the USA. These Centers are sponsored by the Division of Research Resources of the U.S. National Institutes of Health:

National Biomedical ESR Center, Prof. James S. Hyde, Director. Medical College of Wisconsin, MACC Fund Research Center Building, 8701 Watertown Plank Road, Milwaukee, Wisconsin 53226, USA. ☎: 414/266-4000. E-Mail: felixc@medcolwi.BITNET. FAX: 414/266-4007.

Biotechnology Resource in Pulsed EPR Spectroscopy, Prof. Jack Peisach, Director. Albert Einstein College of Medicine, Department of Molecular Pharmacology, 1300 Morris Park Avenue, Bronx, New York 10461, USA. ☎: 212/430-2175. FAX: 212/829-8705. E-mail: Use INTERNET address "peisach@aecom.yu.edu"

Illinois EPR Research Center (IERC), Profs. Harold M. Swartz and R. Linn Belford, Directors; Prof. Robert B. Clarkson, Associate Director; Prof. Peter G. Debrunner, co-Principal Investigator; other senior staff: Prof. Mark J. Nilges and Dr. Tadeusz Walczak; University of Illinois at Urbana-Champaign, 190 Medical Sciences Building, 506 S. Mathews, Urbana, Illinois, 61801, USA. ☎: 217/244-1186. E-mail: belford@uiucscs.BITNET or ierc@uiucvmd.BITNET. FAX: 217/244-8068.

These Centers, which were described in our first issue (Volume 1, #1), cooperate to facilitate research requiring EPR-related techniques. Prospective collaborative or service users may contact the staff at any of the Centers.

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HOW TO REACH US

To communicate concerning the EPR Newsletter, contact R. Linn Belford, Editor or Becky Gallivan, Editorial Assistant, at IERC (address above). Alternatively, contact any other IERC senior staff member or any officer of the International EPR Society. We welcome announcements, news items, notices of events, appropriate articles, and technical tips pertinent to EPR for possible publication.

NOTICE— PUBLICATION SCHEDULE AND DISTRIBUTION POLICY:

With the establishment of the International EPR (ESR) Society and of this newsletter as its official publication, we have the resources to go to a regular schedule of publication of newsletters for society members. Initially, starting in 1991, Newsletters will be sent to members quarterly — in January, April, July, and October. One of these issues each year will be a public issue, which nonmembers on our mailing list also will receive. The material to be published (articles, letters to the editor, advertisements, notices, etc.) should arrive in the editor's office by the fifth day of the month preceding publication of the issue in which it is intended to appear. Material should arrive by December 5, 1990 to be assured of publication in the January, 1991 issue.

To continue receiving all issues of the EPR Newsletter on a regular basis after this issue, please register with the International EPR Society if you have not already done so. A registration form is included with this issue as Appendix IV (p. 16).

NOTICES OF MEETINGS

FIFTH BIENNIAL GENERAL MEETING OF THE INTERNATIONAL SOCIETY FOR FREE RADICAL RESEARCH, Pasadena, CA, USA, November 14 to 20, 1990. The theme will be **Oxidative Damage and Repair**. For details, contact Dr. Kelvin P. Davies, Institute for Toxicology and Dept. of Biochemistry, University of Southern California, 1985 Zonal Ave., Los Angeles, CA, 90033, USA.

ACTIVITIES OF THE EAST GERMAN ESR GROUP: The Magnetic Resonance Group of the Physical Society in eastern Germany organizes two biennial conferences.

A. International Magnetic Resonance Conference (MARECO) (ESR/EPR AND NMR), held in odd-numbered years (invited lecturers). The next one is in 1991. Place: Castle Reinhardsbrunn, Thüringen Mountains, Germany. For details, please contact:

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Professor Dr. Wolfgang Windsch, Section Physics, University of Leipzig, Lönne-Str. 5, Germany.

B. **ESR SYMPOSIUM**, with workshops of the EPR/ESR laboratories in East Germany (in the future, to be in common with West German ESR laboratories), with invited lecturers, held in even-numbered years. The next will be **December 10-15, 1990 in Bad Schandau (near Dresden, in the sandstone mountains)**. For details, please contact: Dr. Günter Lassmann, Central Institute of Molecular Biology, East German Academy of Sciences, Robert-Rössle-Str. 10, 1115 Berlin-Buch (Germany).

In order to improve scientific contacts with colleagues, participants from West European and American EPR/ESR laboratories are cordially welcomed.

TWENTY-FOURTH INTERNATIONAL MEETING OF THE ELECTRON SPIN RESONANCE GROUP OF THE ROYAL SOCIETY OF CHEMISTRY, Royal Agricultural College, Cirencester, Glous., England. April 15-19, 1991. The theme will be "Inorganic Radicals and Metal Ions in Organic and Biological Systems". However, there also will be a session on the application of computers in EPR, and participants may give posters or talks relating to this topic. Among the plenary lecturers will be Prof. R. Cammack (London); Prof. E. de Boer (Nijmegen); Dr. B. Mile (Cardiff); Prof. P. M. H. Kroneck (Konstanz); Dr. M. Schroder (Edinburgh); Prof. D. Rehorek (Leipzig); and Dr. E. Samuel (Paris). The conference will open with a reception on Monday evening and close after lunch on Friday. Attendance will be limited; accommodations will be in individual rooms. The deadline for registration and submission of short papers and posters is February 1, 1991. For details, contact Dr. C. C. Rowlands, Secretary, Committee of the ESR Group, School of Chemistry, Univ. of Wales, PO Box 912, Cardiff CF1 3TB, U.K.

MEETING OF ESR SPECTROSCOPISTS. May, 1991. Each year, a meeting of scientists interested in EPR is held in the last week of May. For details, contact Dr. Andres Stasko,

Department of Physical Chemistry, Slovak Technical University, 81237 Bratislava, Czechoslovakia.

II INTERNATIONAL WORKSHOP ON ELECTRON MAGNETIC RESONANCE OF DISORDERED SYSTEMS, May 27-31, 1991, Gjulechitza, Bulgaria. Organized by the Institute of Kinetics and Catalysis, Bulgarian Academy of Sciences and the Department of Chemistry, Sofia University.

The aim of the workshop is to cover all aspects of recent development in the theory, methodology, experiment, instrumentation, etc. of EPR, ENDOR, AND ESE spectroscopy of disordered systems through lectures given by the top experts and selected applicants.

At the moment, the following world-known scientists are expected to deliver lectures: W. E. Antholine (Natl. Biomed. ESR Center, Wisconsin), M. Brustolon (Univ. Padova), M. Che (CNRS, Paris), A. Colligiani (Univ. Messina), L. R. Dalton (Univ. Southern California, Los Angeles), S. Dikanov (Acad. Sci. USSR, Novosibirsk), G. Eaton (Univ. Denver), U. Ewert (Acad. Sci. DDR), W. Froncisz (Jagellonian Univ., Krakow), J. Freed (Cornell Univ., Ithaca), D. Goldfarb (Weizmann Inst. Sci., Rehovot), A. J. Hoff (Univ. Leiden), B. M. Hoffman (Northwestern Univ., Illinois), J. Hüttermann (Univ. Saarlandes), J. S. Hyde (Natl. Biomed. ESR Center, Wisconsin), M. Ikeya (Osaka Univ.), M. Iwaizumi (Tohoku Univ.), L. Kevan (Univ., Houston), H. Kurreck (Freie Univ., Berlin), Ya S. Lebedev (Acad. Sci. USSR, Moscow), K. Ohno (Inst. Vocational Training, Kanagawa), B. S. Prabhananda (Tata Inst. Fund. Res., Bombay), J. B. Raynor (Univ. Leicester), E. J. Reijersa (Univ. Nijmegen), M. Romanelli (Univ. Florence), D. Schmalbein (BRUKER GmbH, Rheinstetten), B. S. Tsukerblat (Mold. Acad. Sci. Kishinev), Yu. D. Tsvetkov (Acad. Sci. USSR, Novosibirsk), H. van Willigen (Univ. Massachusetts at Boston), Y. Xu (Zhejiang Univ.).

Selected short presentations will be in the form of posters.

The workshop will commence with dinner Monday (May 27th), and will finish Friday (May 31st), after breakfast.

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Deadlines:

Expression of interest - January 15, 1991.

Receipt of Abstracts - January 31, 1991.

Confirmation - February 28, 1991.

Contact: N. D. Yordanov (Convener), Institute of Kinetics & Catalysis, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria (TELEX: 22729 echban; FAX: 359-2-720038; Telephone: 359-2-7131, ext. 2546 or 3917); or G. Gochev (Sci. Secretary), Department of Chemistry, Sofia University, 1, A. Ivanov Avenue, 1126 Sofia, Bulgaria (Telephone: 359-2-62561, ext. 223).

FOURTEENTH INTERNATIONAL EPR SYMPOSIUM at the 33d Annual Rocky Mountain Conference, Denver, CO. July 28 to August 1, 1991. EPR in conducting materials

will be one focus of this meeting. Also, Prof. John A. Weil (University of Saskatchewan, Saskatoon) and Dr. Michael K. Bowman (Argonne National Laboratory) are organizing a session on determining atomic positions by EPR techniques and Prof. Robert B. Clarkson (University of Illinois, Urbana) is organizing a session on EPR standards. Other events will include plenary lectures, topical sessions, general contributed papers, and poster sessions, and a business meeting of the International EPR Society. For further details, contact Prof. Gareth Eaton or Prof. Sandra Eaton, Dept. of Chemistry, University of Denver, Denver, CO, 80208.

INTERNATIONAL SYMPOSIUM ON RECENT ADVANCES IN ESR SPECTROSCOPIES, Padova, Italy. September 8-12, 1991. Joint meeting of The ESR Group of the Royal Society of Chemistry (United Kingdom) and GIRSE (Italy). A more complete announcement will appear in a future issue.

INTERNATIONAL WORKSHOP ON ELECTRON SPIN ECHO SPECTROSCOPY, Novosibirsk, USSR. September 25-28, 1991.

The workshop will deal with problems and applications of ESE spectroscopy. For details, contact Dr. S. A. Dikanov or Dr. A. V. Astashkin, Institute of Chemical Kinetics and Combustion, Novosibirsk, 630090, USSR.

THIRD INTERNATIONAL SYMPOSIUM ON ESR DOSIMETRY, National Institute of

Standards and Technology, Gaithersburg, Maryland, USA. October 14-18, 1991. The symposium will focus on current applications of EPR spectroscopy in the general areas of ionizing radiation dosimetry, archaeological dating, and instrumentation, including imaging and measurements for solid state, biological, and medical applications. However, the topics of discussion are not limited to these, and presentations of new, innovative developments in the EPR field are encouraged. For details and to express interest in attending or submitting an abstract, contact Dr. Marc F. Desrosiers, NIST, Building 245, Room C214, Gaithersburg, MD, 20889, USA; Phone 301/975-5639; FAX 301/869-7682.

TWENTY-FIFTH ANNUAL INTERNATIONAL MEETING OF THE ELECTRON SPIN RESONANCE INTEREST GROUP OF THE ROYAL SOCIETY OF CHEMISTRY (UK), University of York. March 30 to April 3, 1992.

This will be a joint meeting with the Society of Free Radical Research. The theme will be "Radicals in Organic and Bioorganic Systems." For details, contact Dr. C. C. Rowlands, Secretary, Committee of the ESR Group, School of Chemistry, Univ. of Wales, PO Box 912, Cardiff CF1 3TB, U.K.

VI INTERNATIONAL SYMPOSIUM ON MAGNETIC RESONANCE IN COLLOID AND INTERFACE SCIENCE, Florence, Italy, June 22-26, 1992.

The 6th International Symposium on Magnetic Resonance in Colloid and Interface Science will be held at the University of Florence, Florence, Italy, June 22-26, 1992. This is a continuation of the previous triennial conferences held on the same subject in San Francisco, USA (1976), Mentone, France (1979), Torun, Poland (1983), Münster, FRG (1986), and Newark, Delaware, USA (1989). This symposium has become a major event; its aim is to provide a forum for physicists, chemists, and biologists at which they can present and discuss their recent research in the field. The symposium program will include plenary lectures, invited reports, and original research contributions. The official language will be English. The proceedings will be published as full articles in a major scientific journal.

A wide spectrum of the applications of magnetic

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resonance spectroscopies to colloid and interface systems will be addressed. Among the topics to be covered:

- Adsorption, catalysis, and surface chemistry
- Dispersed systems, colloids, and gels
- Ordered systems
- Zeolite and silicate surfaces
- Intercalation compounds
- Biological systems
- Magnetic systems with specific surface

properties

- New magnetic resonance techniques

Other topics can be included depending on the response.

All scientific activities will be held downtown in Florence and all reservations for accommodations will be handled by local travel office directly. Detailed information will be sent in further circulars. Florence is easily reached by train from the international airports of Pisa (one hour), Rome (three hours), and Milan (three hours).

For more information, and to indicate whether you wish to attend, and whether you wish to present a paper, contact: Dr. M. Francesca Ottaviani, Department of Chemistry, University of Florence, Via G. Capponi 9, 5021 Firenze, ITALY.

ESR APPLIED METROLOGY WORKSHOPS, Japan. Prof. Motoji Ikeya (Department of Physics, Faculty of Science, Osaka University, Toyonaka, Osaka 560, Japan) would like members of the international EPR community to know about these workshops. The first such workshop was organized in 1985 at the time of the First Symposium on ESR Dating held at Yamaguchi, Japan; cf. the Proceedings of ESR Dating and Dosimetry (Ionics, Tokyo, 1985). Five annual workshops and symposia have been held. Proceedings are available at a cost. Members are mostly physicists, geologists, and some chemists who are interested in EPR applications to geology and archaeology as well as in the development of EPR imaging (or scanning EPR microscopy) and of portable EPR spectrometers. Publications - "Applied ESR Metrology" and Newsletters with English-language titles - are available to members (dues, \$20/year). For details and Workshop schedules, contact Prof. Ikeya, whose organization wishes to exchange information with foreign EPR specialists and to

encourage more involvement of geologists in the EPR community.

EDITORIAL

As the EPR Newsletter is getting under way as the news medium for the International EPR Society, we renew our call for readers to contribute material which may be of interest to others in the EPR community. The "**Tips and Techniques**" section started with the previous issue is an example. **Articles** and **Notices** containing news, information, and discussions of interest to the EPR community are welcome. However, articles of the sort published in regular journals are not within the scope of the EPR Newsletter. **Letters to the Editor** may express opinions, raise issues, or simply inform. **Requests for information** are printed. We also publish notices of **job openings** and of **positions sought** in the field of EPR and are starting an **equipment exchange** section, where those who wish to sell, give away, trade, or acquire surplus equipment of interest to EPR spectroscopists may place announcements. We urge readers to provide information on **meetings to be held**, on published **proceedings** of meetings, and on recently or soon-to-be published **books** or **conference proceedings** pertaining to EPR; we shall publish such information in the "Notices of Meetings" and "Notices of Books and Conference Proceedings" sections. Some **advertising** material will be accepted from companies which affiliate with the International EPR Society (see the "International EPR Society Reports" below). What else shall be published in the EPR Newsletter? You decide. Tell us what other sorts of material you want printed in these pages, and help us get the copy for it.

EPR, ESR, EMR, or what? The discussion continues. We received a note from Prof. Martyn C. R. Symons (who prefers "ESR"; see the previous issue of this Newsletter) informing us that the Faraday Society has adopted "EPR in preference to "ESR." We intend to keep paying attention to this nomenclature issue, but not to become exercised about it. After all, our aim is unity, not division.

Linn Belford

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INTERNATIONAL EPR SOCIETY REPORTS

MINUTES OF THE MEETING OF THE INTERNATIONAL EPR (ESR) SOCIETY. The meeting was held July 30, 1990 at the 13th Annual International EPR Symposium in Denver. The meeting was chaired by Hal Swartz and minutes were prepared by Gareth Eaton. About 100 scientists from several countries attended the meeting.

I. Reports

Hal Swartz reported on action taken following the organizational meeting that was held in Denver at the 12th International EPR Symposium in 1989.

A. The Society has been incorporated in the State of Illinois as a tax-exempt organization. Bruker Instruments will donate the cost of the incorporation process.

B. A draft Constitution was prepared by the organizing committee, with leadership by James Bolton (Canada) and consultation with a number of scientists. The constitution was modeled on those of other small scientific organizations. See section II.A below for action on this item.

C. Membership now numbers 672, of whom about half have paid dues to the Treasurer of the organizing committee (S. S. Eaton), and about half have paid to regional societies in soft-currency countries. Many additional applications are being processed, so the total membership will soon exceed 700.

D. A Nominating Committee (James R. Bolton (Canada), Chairman, Bruce Gilbert (England), Karl H. Hausser (Germany), and Wayne L. Hubbell (USA)) was appointed by the Organizing Committee. The Nominating Committee selected candidates for the initial officers of the Society. They recommended that there not be competitive elections in order to facilitate getting the Society started. The nominees were: Harold M. Swartz (Illinois) President, Hans Fischer (Zürich) Vice President, Gareth Eaton (Denver) Secretary, and Sandra Eaton (Denver) Treasurer. A list of nominees for Board of Directors was presented (see attached list). The number of nominees was less than the intended size of the Board, so that the Society could move quickly to correct problems of geographic and interest imbalance on the

Board.

E. Hal Swartz is communicating with scientists in several countries with regard to cooperating to achieve the goals of the Society, and in some cases setting up regional affiliates of the Society. There is considerable enthusiasm in several countries (e.g., USSR and China), and in others (especially England), there is still question of the benefits.

F. The EPR Centers Newsletter is gradually becoming adopted by the Society as the Society Newsletter. Linn Belford is Editor. The content will evolve to meet the needs of members. Members are invited to send him material for publication of the type that they would like to see in the Newsletter.

G. Treasurer Sandra Eaton reported that 353 members had paid dues totalling \$7840, and that after mailing, etc., costs and interest income the balance in the Society bank account is \$7725.86. All efforts in behalf of the Society were by volunteers this year, so there were no secretarial costs, and all international contacts by the Organizing Committee (at numerous meetings) were at no expense to the Society except for postage. In addition to the balance on the Treasurer's books, Bruker has offered to pay the costs of incorporation and to provide annual support for the Society. Other potential sponsors are being contacted by the President. Members are urged to provide additional suggestions.

II. Action Items

A. After much debate about the problem of establishing ground rules for adopting a Constitution, which would then specify who could vote, etc. on changes on it, a vote was taken on a multiply-amended motion whose final effect was to accept the draft Constitution as an interim constitution for the next year, with the following changes and understandings:

1. postdoctoral and emeritus membership categories are to be added;
2. a majority, rather than a 2/3 vote, will be required to change the Constitution a year from now;
3. a committee will be appointed to receive suggestions during the next year on changes;
4. members in all categories can vote on the

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Constitution and proposed changes next year;

5. the vote on the Constitution should take place at the 14th International EPR Symposium in Denver in 1991;

6. time will be provided in the meeting next year for voting on proposed changes to the Constitution item by item.

With these understandings, the Constitution was approved as an interim Constitution unanimously, with no abstentions recorded.

The officers of the Society will implement this as follows, to ensure maximum participation of members who will not be able to attend the Denver meeting next year:

The updated Constitution will be sent to all members for approval, and for suggestions of changes. The suggested changes will be discussed in Denver next year, and a vote will be taken to determine which ones should be sent to all members for approval by mail ballot.

B. Election of Officers

The slate of officers and members of the Board of Directors presented by the Nominating Committee was approved unanimously as interim officers. There will be a mail ballot providing opportunity for write-in votes, which will help achieve the desired international and discipline balance in the Society.

It is expected that the next President, Secretary, and Treasurer will not all be from the USA.

C. Functions of the Society.

It is expected that the major functions of the Society will be accomplished *via* committees of members who see a need and work to fulfill it. Initially, the Organizing Committee suggests standing committees to deal with issues of:

1. Society functions such as elections, awards, by-laws, etc., as specified in the Constitution;

2. meetings and workshops — especially dealing with requests for the Society to give its name as a sponsor of existing or separately organized meetings and decide where the business meeting of the Society should be held, not to establish new meetings;

3. nomenclature — this is a continuing problem;

4. software — Richard Cammack (London) has volunteered to lead this committee, bringing to

the Society his efforts to achieve international cooperation in this area;

5. hardware — e.g., following up on the Workshop on the Future of EPR held in Denver in 1987;

6. standards - e.g., coordinating with the existing group to set up EPR standards (see EPR Newsletter Vol. 2 No. 2 April 1990).

Anyone willing to serve the EPR community *via* service on these or other committees is encouraged to contact the interim President, Hal Swartz.

D. The issue of a Society Journal was raised. It is not the intent of the Society to create a new journal. Rather, the Society will seek to negotiate member discounts for subscriptions to existing journals. A regularly published newsletter will serve as the Society's communication with members. A computer bulletin board for members was suggested. Linn Belford will look into establishing this means of communication for those who have access to international electronic mail such as BITNET. Mike Bowman described the first issue of the journal Applied Magnetic Resonance, edited by Kev Salikhov in Kazan, USSR (with regional editors in Germany and the USA). The table of contents and an invitation to submit papers for review was placed in the poster session of the Symposium by the Eatons. See also, EPR Newsletter Vol. 2, No. 2, April 1990.

There being no further business, the meeting was adjourned until the 14th International EPR symposium in Denver in 1991.

Minutes submitted by Gareth Eaton

Report and Comments by the interim President of the International EPR (ESR) Society

The formation of the Society continues to progress. The materials in this mailing, directed to the members of the Society, summarize some of the steps that have been taken and plans for the future. For those of you who already are members, a ballot is enclosed which you are urged to complete and return as soon as possible, in order to complete the last steps in the formation of the Society. There also is a form on which you

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INTERNATIONAL EPR SOCIETY CORPORATE MEMBERSHIP CATEGORIES

Class of Affiliation	Minimum Level of Contribution	Display Space (approximate)	Other Privileges
Patron	\$5,000	5 x 18 centimeters	May insert up to two pages of promotional material in every edition of the Newsletter
Sponsor	\$1,500	5 x 18 centimeters	May insert up to one page of promotional material once per year
Supporter	\$750	5 x 18 centimeters	
Contributor	\$350	5 x 9 centimeters	

are asked to indicate the areas in which you are willing to work for your Society.

Those who are not members of the Society, note that the Society now subsidizes the Newsletter. Thus, a regular and more frequent publication schedule and a new distribution policy, providing that most issues will go to members only, have been established; see p. 1 of this issue. You are cordially invited to join your fellow scientists as members of the Society so that you will continue to receive all of the issues of the Newsletter and the other benefits of membership and, most importantly, contribute to the development and encouragement of this important area of science.

In addition to individual membership, the Society also has provisions for corporate membership. Corporate membership includes the opportunity to describe the products of the company to the members of the Society through the EPR Newsletter, according to the table above.

Members of the Society are urged to encourage their colleagues, including students and post-docs, to join the Society. We hear comments from some colleagues that EPR is a limited and exotic specialty; their attitude starts to change when they hear how rapidly the new Society is growing. The size of the membership affects the impact of Society generally, and particularly on other organizations — commercial, professional, and governmental. The size that we have reached already (about 800) has elicited very positive responses from a number of organizations. With your efforts, the size and thereby the impact and influence of the Society will continue to grow.

Harold M. Swartz, Interim President

LETTERS TO THE EDITOR

Sir:

Perhaps by now some EPR spectroscopists have noticed publication of "IUPAC Recommendations for EPR/ESR Nomenclature and Conventions for Presenting Experimental Data in Publications" in *Pure & Appl. Chem.* **61**, 2195-2200, 1989. This is an amplified version by myself of the draft started originally by Professor J. R. Bolton in 1977.

As stated therein, this document does not include terminologies, etc., in some areas of EPR spectroscopy such as saturation-related/time-resolved phenomena and $S > 1/2$ systems. Those of you who are interested in extending this work are encouraged to contact IUPAC, Physical Chemistry Division, Commission on Molecular Structure and Spectroscopy —

Chairman: Prof. C. J. H. Schutte, Faculty of Science, University of South Africa, P. O. Box 392, Pretoria 0001, Republic of South Africa; Tel: +27(12)4402355, and/or

Secretary: Dr. Joann F. Sullivan, Department of Chemistry, University of South Carolina, Columbia, SC 29208, Tel: +1 (803) 777-7607

Hideo Kon
Building 2, National Institutes of Health
Bethesda, MD 20892 USA

Sir:

In the last issue of the EPR Newsletter, Prof. Albert M. Bobst had raised some important

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questions concerning the sensitivity of EPR spectrometers with lossy and low-loss samples. Specifically, he attained a much better S/N (Signal to Noise Ratio) with weak pitch on his Bruker spectrometer than on his Varian spectrometer; however, the S/N with an aqueous solution of a nitroxide spin label (lossy sample) was slightly higher on his Varian spectrometer. These two seemingly contradictory observations have a simple explanation.

First, for low-loss samples, the Q of the cavity is high and frequency instabilities are efficiently converted to AM noise in the signal. The AFC (automatic frequency control) must be carefully designed to eliminate this source of noise because it can be the limiting factor in the sensitivity of an EPR spectrometer. Because of the design of the Bruker AFC, we have achieved significant improvements in the S/N for low-loss samples.

Second, for lossy samples, the Q is reduced and noise due to frequency instabilities is suppressed; therefore, the detector diode is the limiting factor in the sensitivity of the spectrometer. Professor Bobst had upgraded the detection diode in his Varian spectrometer leading to excellent detection sensitivity for lossy samples. We use Schottky barrier diodes which exhibit very low $1/f$ (inverse frequency) noise, and we statistically achieve better sensitivity. In this case, selection of a new diode raised the sensitivity substantially, now exceeding that of the older instrument.

Achieving higher sensitivity for lossy samples is a daunting task, but we are actively pursuing new means of improving the sensitivity for this important class of samples.

Dr. Ralph T. Weber, EPR Division
Bruker Instruments, Inc.
19 Fortune Drive
Billerica, MA 01821, USA

FROM THE CENTERS

SPECIAL FACILITIES OPEN TO USERS -

Both the W-band (95 GHz) and the *in vivo* L-band (1-2 GHz) facilities which are in development at the IERC in Urbana are now open to outside users for exploratory experiments. To determine current

status and discuss the possibility of using these facilities, contact IERC personnel at the address listed on p. 1 of this Newsletter.

BIOTECHNOLOGY RESEARCH RESOURCE IN PULSED EPR SPECTROSCOPY — Chris Bender joined the faculty of this Center in 1989. He is engaged in microwave facilities developments and, in the Tips and Techniques column below, offers some observations on the role of MMIC's in EPR instrumentation.

TIPS AND TECHNIQUES

In response to several requests for publication of technical tips, hints, and helpful descriptions of techniques relevant to EPR work, this Tips and Techniques section of the Newsletter was begun in the previous issue. The idea is to share with other readers technical information which you feel would be useful to others but not appropriate for formal publication in a regular journal. The Editor invites contributions to this section.

ENDOR Tip — Method to Increase FM Range and Provide Smooth Modulation with a Frequency Synthesizer:

In our frequency-modulated ENDOR experiments in which a PTS frequency synthesizer provides the RF signal, we noticed ENDOR artifacts in the vicinity of certain synthesizer frequencies. These artifacts are occasioned by the lack of agility of the synthesizer when one attempts to modulate across the dividing line between two frequency bands in the synthesizer. Moreover, frequency sources often have limited amplitudes of frequency modulation. To eliminate both problems, we do not modulate the primary RF frequency source. Instead, we use it to provide a stable ramped source of RF power (v_1), which is then mixed with a fixed-frequency modulated source (v_2) capable of a wide modulation amplitude. After processing with a high-pass or low-pass filter, the stable ramped and properly modulated sum or difference frequency ($v_1 \pm v_2$) remains to drive the RF power amplifier. This

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mixing scheme has been used routinely in our laboratory for about three years and has completely eliminated the modulation artifacts. A particular implementation of this idea using a surface-acoustic-wave device is described by R. B. Clarkson, R. L. Belford, and C. Reiner in the *Review of Scientific Instruments* 1990, 61, 3356-3359. Plans will be provided on request.

R. Linn Belford and Robert B. Clarkson
Illinois EPR Research Center
Univ. of Illinois at Urbana-Champaign
Box 19, 505 S. Mathews
Urbana, IL 61801, USA

Techniques — MMICs in EPR Instrumentation:

The engineering aspects of spectrometers for EPR are largely dictated by advances in the microwave electronics field which, in turn, is driven by the economics of supplying the needs of the military and industry. As a result, spectrometers have been designed in a manner that could always stand for improvement. The principal reason for this is the fact that microwave circuits have traditionally been built using coaxial and/or waveguide transmission lines, which severely limit the versatility and efficiency of spectrometric applications and have an intrinsically narrow bandwidth. Recently, however, semiconductor materials and integrated circuits have been developed for microwave applications, and these new circuit elements will greatly influence the design of EPR spectrometers.

The recent godsend to microwave electronics is the MMIC (pronounced 'mimic'), which stands for Monolithic Microwave Integrated Circuit and is essentially the microwave equivalent of the solid-state VLSI chip. MMIC devices are fabricated from a semiconductor substrate (usually GaAs) using etch and molecular beam epitaxy methods, and, in terms of sophistication, can be as simple as a single component (e.g., a filter), or as complex as a complete microwave subassembly (e.g., a receiver). In principle, an entire spectrometer bridge could be designed as a compact subassembly which would greatly

increase the efficiency of microwave delivery to the sample. Greater integration of circuit components would also improve our ability to design spectrometers that are more versatile in terms of function.

Many of the miniature coaxial components (e.g., directional couplers, phase shifters, etc.) that we now purchase to replace the older waveguide components, are actually microwave integrated circuits (MICs). They consist of several active and passive components that are affixed to a dielectric substrate and connected by microstrip transmission line. MMICs work on the same principle, except that all components are fabricated from the same semiconducting material. Onto an insulating GaAs substrate layers of doped GaAs are deposited, from which the components that are to be conducting will be fabricated. The high performance of circuits fabricated in this manner stems from the lack of an interface between dissimilar materials as occurs in MICs when discrete components are soldered to substrates. The fabrication process also allows for the placement of more than one component on a single wafer, making it possible to integrate a complicated circuit (e.g., a spectrometer bridge) onto a single board.

There are several advantages that result from the MMIC technology. Most obvious are those that are due to the mode of fabrication. Since discrete components are not being attached to microstrip, one greatly reduces parasites that typically occur at these junctions. The lumped element construction also allows for greater optimization of individual components for the best possible overall circuit performance. GaAs MMICs are lossier than more traditional transmission lines; however, this can be compensated by the fact that components can be packaged in a smaller area.

GaAs MMICs work well over a wide frequency range (generally 2-40 GHz), and circuits often have the attribute of being operable over multiple octaves. The ramification most beneficial to the EPR spectroscopist is that this technology makes possible a spectrometer bridge that is operable over more than one band (a reasonable range

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would be 2-20 GHz). Conceivably, one could construct a bridge consisting of a low noise oscillator, varactors for frequency doubling, and a MMIC that consists of the appropriate amplifiers, mixers, etc. (this is, by the way, also true of MIC technology).

High frequency EPR spectroscopy has started to become more widely used, and MMICs are almost certain to influence this field. Low noise amplifiers that operate at mm-wave frequencies have been designed with this technology and have provided some advantages over components that have been in use. Currently, MMIC components are available that operate well up to 40 GHz. There are reports of 94 GHz components being developed (using AlGaAs as a substrate), but gains of transistors are severely limited at higher frequencies; the problems at 94 GHz, for example, are associated with maintaining the requisite size tolerances on submicron components that are etched into the wafer. Nonetheless, the industry is motivated to succeed at 94 GHz due to the radar and electronics warfare marketplace, so we may have some hope for advances.

For economic reasons, MMIC technology will most affect those of us who build spectrometers. The nature of the fabrication process makes it very expensive to develop a circuit, but it is very cheap to produce MMICs in large quantities. The advantage of MMICs over conventional MICs on large production runs is that the former are far less labor intensive to construct. What this means is that high performance components that can be sold in large quantities (e.g., switches, amplifiers, mixers) can be obtained at a much reduced cost, although customized items (e.g., a spectrometer bridge) are prohibitively expensive unless one plans to sell many. Since the high cost of low-production items reflects the difficulty of the design/fabrication process, one can hope that improvements in computer-aided design and production methods (especially the preparation of masks for the deposition/etch processes) will reduce costs.

Discrete components, such as amplifiers, switches, etc., are available at relatively low cost,

and these may be incorporated into a spectrometer with an accompanying improvement in performance. For example, in our own laboratory, we have been able to purchase very fast microwave switches for our pulsed spectrometer. These switches are MMIC GaAs FETs that have a switching time of 1-2 ns. They are supplied as wafers that can be incorporated into a microstrip circuit as part of the construction of the spectrometer bridge. However, for prototyping and testing circuits, I use a circuit design and test package sold by Hewlett Packard. Modular Microcircuit Package (HP 83040 Series) consists of an rf-shielded box that is fitted with 'launch' connectors (a bulkhead coax-to-microstrip connection). One can insert a discrete component into these boxes and incorporate the entire assembly into a coax microwave circuit. For the most part, however, components can be purchased prepackaged and incorporated via standard SMA coax connections.

Chris Bender
Biotechnology Resource in Pulsed EPR
Spectroscopy
Albert Einstein College of Medicine
1300 Morris Park Avenue
Bronx, NY 10461, USA

UPDATES, NOTICES, AND REQUESTS

Spin Trapping Database (STDBII) Update

by Colin F. Chignell
Laboratory of Molecular Biophysics
P. O. Box 12233
Research Triangle Park, NC 27709

An updated version (4.03) of STDBII (for IBM and Macintosh computers), a spin trapping literature database (see ESR Centers Newsletter Vol. 1, #3, July 1989; Li, et al. J. Magn. Res. 79:140 (1988)), is now available. The new version contains over 7000 entries from papers published up to July, 1990. A new feature of STDBII (4.03) is the inclusion of the a_{NH} ratio (NoH value) for each entry. The NoH value is a useful parameter which can aid in the identification of DMPO spin adducts, particularly in aqueous solution (Li *et al.*, J. Biochem. Biophys. Methods, in press). Registered users of STDBII will automatically

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receive the new version. Other individuals who are interested in receiving a copy of the program should contact Dr. Chignell at the above address; Telephone (919)541-3196; FAX (919)541-7880; E-mail: CHIGNELL@NIEHS.BITNET.

VHF EPR in GRENOBLE

Dr. J. B. Robert informs us that an interesting very-high-frequency EPR spectrometer is in operation at Services National des Champs Intense (S.N.C.I.) in Grenoble. Dr. Robert is interested in recording spectra for other groups in Europe or elsewhere. The instrument has been described by A. L. Barra, L. C. Grund, and J. B. Robert, Chem. Phys. Lett. 165, 107-9 (1990). It uses a CO₂ laser as a source, operating at 8.17, 14.3, or 17.5 cm⁻¹, a single-pass (Q=1) transmission cell, and a resistive Bitter coil in a transient sweep. Contact Dr. J. B. Robert, S.N.C.I., C.N.R.S., B.P. 166X, 38042 CEDEX France; Telephone 76.88.10.01; Telex 320823F.; FAX 76.87.21.97

UPDATE: AMR, A NEW JOURNAL

APPLIED MAGNETIC RESONANCE is a new journal targeted toward the variety of applications of magnetic resonance in physics, chemistry, biology, medicine, engineering, geochemistry, ecology, and related fields. AMR is the first English-language scientific journal to be published and produced in the Soviet Union. It is advised by an Editorial Board composed of over 50 distinguished scientists of several countries.

AMR is an **international** journal for the publication of high-quality, original Papers and Letters to the Editor. It will also contain book reviews, information on conferences and technical equipment, and invited review articles on methods and applications of NMR, NQR, EPR, Mössbauer, and related spectroscopies. The emphasis will be on new applications of the techniques and new experimental methods. No page charges will be assessed.

Manuscripts can be sent to any of the following editors:

1. Prof. Kev M. Salikhov, Editor
Zavoisky Institut

Sibirsky trakt 10/7

Kazan, 420029, USSR

2. U. Haeberlen, Associate Editor
Max-Planck-Institut für Medizinische Forschung
Arbeitsgruppe Molekulare Physik
Jahnstrasse 29
D-6900, Heidelberg, FRG
3. Keith R. Carduner, Associate Editor
Ford Motor Co. Scientific Research Labs.
P.O. Box 2052
Dearborn, Michigan 48121-2063, USA.

For more information or a free sample of the first issue, write Springer-Verlag, who will distribute AMR outside the USSR: Springer-Verlag Wien New York, Attn. Mr. R. Petri-Wieder, P.O. Box 367, Moelkerbastei 5, A-1011, Wien, Austria.

POSITIONS OPEN

ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY IN BIOLOGICAL MATERIAL: ASSISTANT RESEARCH SCIENTIST. A Ph.D. level Assistant Research Scientist (tenure-track, fiscal year appointment) is sought by the Department of Botany at Arizona State University. Expertise in EPR spectroscopy with biological systems is required, and experience with ENDOR is preferred. The successful candidate is expected to develop an independent research program compatible with current research emphases within the Department. In lieu of formal teaching obligations, responsibilities will include user training and maintenance of the newly acquired EPR spectrometer with ENDOR capabilities. Applicants should submit their CV and a statement of research interests, and have three letters of reference sent to:

Wim Vermaas, Search Committee Chair
Department of Botany
Arizona State University
Tempe AZ 85287-1601
Telephone (602)965-3698; FAX (602)965-2012.
The application deadline is November 30, 1990, or the 30th of each month thereafter until the position is filled. Affirmative Action/Equal Opportunity Employer.

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POSITIONS WANTED

Experienced scientist, Ph.D., D.Sc. arriving in New York from USSR late 1990. Age 43, married, 2 children. Experience in teaching and research in the following areas: magnetic resonance and related phenomena in dielectrics and semiconductors; solid state optics; ferroelectricity and dipole glasses; phase transitions in disordered systems; surface physics, superconductivity; 55 publications. For full Curriculum Vitae, contact

Dr. B. E. Vugmeister
22-26 A. Barbusa Str., Apt. 31
52005 Kiev, USSR
Telephone: 44-268-9663.
(Alternatively, Becky Gallivan, Illinois EPR Research Center, can furnish a CV.)

EQUIPMENT EXCHANGE

Wanted: a Varian V-3505 Chopper Amplifier for a magnet power supply. Contact

Dr. David Keeble
Department of Physics
Michigan Technological University
Houghton, MI 49931, USA.
Telephone (906)487-2832.

Wanted: Used EPR Spectrometer. We would like to buy a used EPR spectrometer, Varian E4 or better. Please contact

Dr. M. T. Santini or Professor P. L. Indovina at:
IWFN - Sezione Sanita
Istituto Superiore In Sanita
Viale Regina Elena, 299
00161 Rome, ITALY
Telephone (+396)445-7163
FAX (+396)446-2872

APPENDICES

APPENDIX I. MEMBERS OF THE COUNCIL OF THE INTERNATIONAL EPR SOCIETY. A list (to be ratified by the Society membership by mail ballot) of the COUNCIL as of October 15, 1990 follows; the officers (President, Vice-President, Secretary, and Treasurer) are not listed here but are also automatically members of the Council:

Professor J. J. Andre
Institut Charles Sadron
FRANCE

Professor Riccardo Basosi
University of Siena
ITALY

Professor A. J. J. Beckwith
Australia National University
AUSTRALIA

Professor R. Linn Belford
University of Illinois
USA

Professor Lawrence J. Berliner
Ohio State University
USA

Professor Albert Beth
Vanderbilt University
USA

Professor E. de Boer
Katholieke University, Nijmegen
NETHERLANDS

Professor James R. Bolton
University of Western Ontario
CANADA

Professor Donald C. Borg
Brookhaven National Laboratory
USA

Professor Marina Brustolon
University of Padova
ITALY

Prof. Harvey A. Buckmaster
University of Calgary
CANADA

Professor Alwyn G. Davies
University of London
UNITED KINGDOM

Professor K. P. Dinse
Universität Dortmund
GERMANY

Professor Anders Ehrenberg
University of Stockholm
SWEDEN

Professor Dr. Richard R. Ernst
Eidg. Techn. Hochschule
SWITZERLAND

Professor Piotr Fajer
Florida State University
USA

Professor J. H. Freed
Cornell University
USA

Professor Wojciech Francisz
Jagellonian University
POLAND

Professor Dr. Karl H. Hausser
Max-Planck-Institute für Med.
GERMANY

Professor N. Hirota
Kyoto University
JAPAN

Professor James S. Hyde
Medical College of Wisconsin
USA

Professor Melvin P. Klein
Univ. of California at Berkeley
USA

Professor Ya S. Lebedev
Academy of Sciences of USSR
USSR

Dr. Ronald P. Mason
Lab. Mol. Biophys., NIEHS
USA

Dr. Keith A. McLaughlan
Oxford University
UNITED KINGDOM

Professor Dr. Klaus Möbius
Freie Universität, Berlin
FRG

Professor Etsuo Niki
University of Tokyo
JAPAN

Professor Jack Peisach
Albert Einstein Coll. of Medicine
USA

Dr. John Pilbrow
Monash University
AUSTRALIA

Professor Bruce H. Robinson
University of Washington
USA

Professor K. M. Salikhov
Zavoisky Phys.-Tech. Inst.
USSR

Professor Tadeusz Sarna
Medical Coll. of Wisconsin, USA
and Jagellonian Univ., POLAND

Professor Dr. Arthur Schweiger
Eidg. Techn. Hochschule
SWITZERLAND

Professor Tadamasu Shida
Kyoto University
JAPAN

Professor Martyn C. R. Symons
The University of Leicester
UNITED KINGDOM

Professor David D. Thomas
Univ. of Minnesota Med. School
USA

Professor John A. Weil
University of Saskatchewan
CANADA

Professor Dr. Hans C. Wolf
Universität Stuttgart
GERMANY

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APPENDIX II. Provisional Constitution of the International EPR(ESR) Society

Article I. Name

The name of this Society shall be the International EPR (ESR) Society hereinafter called the SOCIETY.

Article II. Objectives

The objectives of the SOCIETY shall be:

- (a) To advance and stimulate knowledge of the principles, recent developments, and applications of Electron Paramagnetic Resonance (EPR) spectroscopy;
- (b) To communicate information and news about EPR and its applications among its members and to serve as a clearing house on EPR among scientists in academia, government, and industry;
- (c) To encourage appropriate and useful application of EPR in a wide variety of fields including physics, chemistry, biology, medicine, geology, and other disciplines;
- (d) To provide a central voice for the EPR community by promoting support for research and development utilizing EPR through interaction with other societies, government funding agencies, and international scientific organizations;
- (e) To stimulate educational programs on EPR and related spectroscopies through organization of schools, workshops, courses, and seminars;
- (f) To foster scientific interaction among EPR spectroscopists throughout the world and to engage in any lawful activities which further this end.

The SOCIETY is to be international in scope and is to cover the entire range of disciplines that use EPR.

Article III. Membership

1. The SOCIETY shall consist of Regular Members, Student Members, Associate Members, and Institution Members.
 - (a) Regular Members. Any person who has made a personal contribution to the advancement of EPR or its applications shall be eligible to become a Regular Member.
 - (b) Student Members. Any student actively engaged in EPR research or its applications shall be eligible to become a Student Member.
 - (c) Postdoctoral Members. Any person engaged in EPR research or its applications and holding a postdoctoral position shall be eligible for this status of membership for up to three years.
 - (d) Associate Members. Any person supporting the objectives of the SOCIETY, and who is not eligible as a Regular Member, shall be eligible to become an Associate Member.
 - (e) Emeritus Members. Any person whose professional activities qualify him/her for status as a regular member and who holds emeritus status or the equivalent.
 - (f) Institution Members. Any institution supporting the objectives of the SOCIETY shall be eligible to become an Institution Member.

2. Admissions. Persons satisfying the required conditions may become Members of the SOCIETY, in the appropriate category, on making written application to the Secretary of the SOCIETY and on paying the membership fee established for that category.
3. Rights and Privileges. All Members of the SOCIETY shall have the right to attend any meeting of the SOCIETY and to participate in the discussion, to hold office, and to vote on candidates for office and on matters of policy.
4. Termination of Membership. Membership of the SOCIETY may be terminated by resignation in writing, or, as provided in Article VIII, by nonpayment of membership fees.

Article IV. Council and Officers

1. Council. The management of the SOCIETY shall be vested in a Council consisting of the President, the Vice President, the immediate Past President, the Secretary, the Treasurer, as Officers, and elected Council members. The Council shall consist of not less than 20 members nor more than 40 members, plus the Officers. The composition of the Council shall provide for a balanced international and geographical distribution, as well as a proper balance of researchers in different branches of EPR.

The term of office of elected members of the Council shall be three years, subject to re-election for no more than one further period of three years.

The Council shall meet at least once per year, normally during a suitable scientific conference. Business may be transacted by mail between meetings. The Council will determine its own rules of conduct of business.
2. President. The President shall be the chief executive officer of the SOCIETY and shall chair meetings of the Council. The President shall direct the general affairs of the SOCIETY and execute such other duties as may be determined by the Council. The term of office of the President shall be three years, and any person may serve only one term as President, except that if the Vice President succeeds to the office as a result of the death, disability, or resignation of the President, such service shall not be counted as a regular term.
3. Vice President. The Vice President will carry out any duties assigned by the President or Council, will carry out the duties of the President in the absence of that person, and shall assume the office of President in the event of the death, disability, or resignation of the President. The term of office shall be three years.
4. Secretary. The Secretary shall maintain all the records of the SOCIETY, shall keep the minutes of SOCIETY meetings, and be responsible for the distribution of all essential information to members. The term of office of the Secretary shall be three years, subject to re-election for no more than two further periods of three years.
5. Treasurer. The Treasurer shall have custody of all funds of the SOCIETY, collect all dues and disburse funds in accordance with the direction of the Council. The Treasurer shall maintain proper books of accounts for the SOCIETY. The term of office of the Treasurer shall be three years, subject to re-election for no more than two further periods of three years.
6. Executive Committee. The SOCIETY's day-to-day affairs shall be conducted by the Executive Committee in accordance with the general directions of the Council. The Executive Committee

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shall consist of the President, the immediate Past President, the Vice President, the Secretary, and the Treasurer.

Article V. General Meetings

1. General Meetings of the SOCIETY shall be held during suitable scientific meetings at least once every three years. All participants at that scientific meeting may attend and speak at such meetings, and may vote. The President of the SOCIETY, or the President's designate, shall chair any General Meeting.
2. Quorum. The Quorum for a General Meeting shall be at least 20 Members in attendance. By decision of the Council any matter deemed to be of major impact on the SOCIETY shall be submitted to the Membership for a mail ballot.

Article VI. Standing Committees

1. In addition to the Executive Committee, there shall be the following Standing Committees:
Nominating Committee
Elections Committee
Awards Committee
The Council may appoint other Committees as required. Recommendations concerning Conferences, Symposia, Courses, and Schools shall be the business of the Executive Committee. A majority of a Committee shall constitute a quorum for business. All recommendations of the Committees are subject to approval by the Council.
2. Nominating Committee. The Nominating Committee shall consist of at least five persons appointed by the Council to serve for three years. The immediate Past President shall be an automatic member of the Nominating Committee and shall chair its meetings. The members of the Nominating Committee shall have an international distribution and reflect a range of scientific aspects of EPR. Members of the Nominating Committee may not be candidates in the elections as officers and of members of the Council. They shall have particular regard to a geographical and international distribution of nominees and to balance of scientific aspects of EPR. In particular, successive Presidents should come from different countries. Nominations may also be received by petition signed by a least five Regular Members and accompanied by a written statement from the nominee of willingness to serve.
3. Elections Committee. The Elections Committee shall consist of three members from different institutions appointed by the Council to serve for three years. Members of the Elections Committee may not be candidates in the elections as Officers of the SOCIETY. The Elections Committee shall conduct all elections and mail ballots of the SOCIETY.
4. Awards Committee. The Awards Committee shall consist of five members appointed by the Council to serve for three-year terms. Any member of this Committee may be appointed by only one additional three-year term. The Awards Committee shall administer all awards of the SOCIETY, shall solicit nominations for awards, and decide on winners of awards. No member of this Committee may be a nominee for any award of the SOCIETY.

Article VII. Elections

1. The Members shall vote on ballot papers distributed to them by the Secretary. The ballot papers shall be returned to the Office of the SOCIETY in signed, sealed envelopes by mail. Mail

ballots must be received prior to a date specified by the Secretary after consultation with the Elections Committee.

2. On receipt of all the ballots for an election, the Secretary shall turn over the ballots to the Elections Committee, which shall open the ballots, tally the votes, and prepare a report of the election, which shall be circulated to members of the SOCIETY.
3. Elections will be held every three years. In the event that an Officer of the SOCIETY of the Officers and Council becomes vacant due to any cause, the Nomination Committee will nominate a candidate or candidates and a special election will be carried out as soon as feasible.

Article VIII. Fees

1. Fees. The fees (annual subscription) for the various membership categories of the SOCIETY shall be determined by the Council.
2. Waiver of Fees. The Treasurer may waive the membership fee of a Member for good reason. If because of currency restrictions in a Member's country, Members shall have the option to pay their dues in the currency of their country to a Committee in that country that has been established by the SOCIETY.
3. Nonpayment of Fees. A Member who has not paid the appropriate membership fee by three months after the expiration of the membership period shall be sent a notice of pending termination of membership. If the fee has not been paid by six months after the expiration of the membership period, that person shall cease to be a Member of the SOCIETY.

Article IX. Miscellaneous Provisions

1. Incorporation. The Council may arrange for the SOCIETY to be incorporated in a particular country or state, if it is deemed advantageous to do so. If, for the purposes of incorporation, the SOCIETY requires a Board of Directors or Trustees, then the members of the Council shall be the Directors or Trustees.
2. Office of the SOCIETY. The Office of the SOCIETY shall be established at an address determined by the Council.
3. The Financial Year of the SOCIETY shall be the same as the calendar year.
4. Audit. The accounts of the SOCIETY shall be reviewed annually by appropriate independent professionals. A report shall be presented to the Council and reported to the membership.
5. Divisions. The Council may approve the formation of Divisions to encompass specialized areas of scientific interest within the EPR field, and shall determine the conditions of operation of such Divisions.
6. Affiliations. The SOCIETY may maintain affiliations with other appropriate organizations as determined by the Council.
7. Amendments. Any provision in the constitution may be amended, or repealed by two-thirds majority of the Members casting ballots in a mail ballot, except that for the first two years of the existence of the SOCIETY a simple majority of those voting will be sufficient.
8. Dissolution. The SOCIETY may be dissolved by a two-thirds majority of those Members casting ballots in a mail ballot. The assets of the SOCIETY will be distributed in a manner determined by the Council and in accordance with the provisions of the Articles of Incorporation, in a manner that is consistent with the non-profit status of the SOCIETY.