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PREFACE

Contributions of Gareth and Sandra Eaton to the EPR Community via the EPR Symposium at Denver and the International EPR Society

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In this area of their scholarly contributions, Gareth and Sandy worked together so seamlessly that there is no point in trying to separate out their contributions, so with a few exceptions, we group together their roles. With their life-long interest in teaching and mentoring, much of their academic efforts have been directed towards educating and informing the EPR community, and therefore, they have been very active in facilitating meetings, workshops, and professional organizations. The magic power that has fueled the EPR Symposium since 1978, was captured with great accuracy by Dr. Ohnishi in 1996 (Fig. 1).

Although this dynamic duo has made very important contributions across a wide range of meetings and scientific societies, I have chosen to focus on three aspects where their impact has been especially significant: the "Denver EPR Meetings", Topical workshops, and the International EPR Society.

Much of the following historical information has been adapted from a description provided to me by Gareth, for which I am very grateful. But any errors or inconsistencies are entirely attributable to me.

1 The EPR Symposium

The first EPR symposium in Denver was held in 1978, organized by the initiatives of Gareth and Sandy. Since then it has continued annually, although in some years the "Denver Meeting" migrated to other sites in Colorado, eventually there seemed to be a consensus to return to Denver. Initially it was part of a broader

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Fig. 1 A sketch illustrating the role and capabilities of the Eatons in advancing the EPR Symposia

analytic chemistry meeting but more and more the magnetic resonance parts dominated in attendance and prestige and eventually it evolved to a magnetic resonance meeting.

The first program is shown in Fig. 2. It included critical aspects that continue to the present day: outstanding lead speakers (Ed Janzen was the first speaker in the EPR Symposium, covering the emerging hot topic of spin trapping), including a wide range of subjects across physics, chemistry, and biology reflecting the activity in EPR at the time, significant inclusion of technical and instrumental aspects, and important scientific contributions from the Eaton lab. Another ongoing tradition was initiated, a workshop held separately in time and place from the regular meeting schedule but well-coordinated with the meeting: an Open House held at the U. of Denver titled "Demonstration of the University of Denver Computer-interfaced EPR Facility."

The success of the first symposium was indicated by the fact that in the second year, 1979, 63 papers were presented on a wide range of topics by many of the academic leaders in EPR. The first session of the second Symposium was chaired by John Wertz, whose fundamental studies and textbook taught so many of us. Honoring outstanding contributors to the field became a recurring theme of the meetings. During the first 30 years of the "Denver" meetings, the Eatons actively selected topics and moderated to guide the development of the field. They strived to identify and stimulate new ideas at an early stage and bring them to the attention of the EPR community via the Symposium. To broaden the input on topics to cover, each year they invited people to suggest topics for future years, and accepted most (almost all) volunteers to organize half-day sessions at the

20th Annual Rocky Mountain Conference
on Analytical Chemistry

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

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

9:00 Introduction - Dr. Gareth R. Eaton

9:05 Detection of Free Radicals in Aqueous Solutions by Spin Trapping, E. G. Janzen, University of Guelph.

10:00 ESR Studies of Stable Spin Probes in Liquid Crystals, G. V. Bruno and M. P. Eastman, University of Texas at El Paso.

10:50 Thermal and Spin Label Studies of Scorpion Cuticle, T. R. White and W. S. Glaunsinger, Arizona State University.

11:30 The Internal Viscosity of Spinach Thylakoids, A Spin Label Study, S. P. Berg, D. M. Luxczakoski, and P. D. Morse, II, University of Denver and Wayne State University.

2:00 Metal-Nitroxyl Interactions, P. M. Boymel, G. A. Braden, J. R. Chang, D. L. DuBois, K. More, R. E. Smith, D. J. Greenslade, G. R. Eaton, and S. S. Eaton, University of Denver, University of Exxex and University of Colorado at Denver.

2:40 Analysis of EPR Spectra of Spin-Labeled Copper Complexes, D. L. DuBois, G. R. Eaton, and S. S. Eaton, University of Denver and University of Colorado at Denver.

3:10 EPR Studies of $[FeNO]^7$ Complexes, R. D. Feltham, H. Crain, and T. Malone, University of Arizona.

3:35 EPR Linewidths in Linear Chain Systems, B. Garrett, Florida State University and S. Holt, University of Wyoming.

4:15 Charge Compensation in the Impurity Centers of Doped Ionic Crystals. Determination by EPR Spectroscopy, G. L. McPherson, Tulane University.

Evening - Demonstration of the University of Denver computer-interfaced EPR facility.

Fig. 2 Program for first EPR Symposium at Denver

Symposium if they followed through and actually did the organization (which has been the case in about 50% of the instances).

The first 30 years of the EPR Symposium were described in 2008 in Volume 18, no. 2–3, of the EPR Society Newsletter. Contributions to the celebration were made by Christoph Boehme, Harold Swartz, and Gareth R. Eaton in brief talks at the banquet, attended by over a hundred people. Christoph sketched the history of EPR in materials science by citing a multitude of important papers published in the past 30 years. Hal described contributions of his lab and other close colleagues to preclinical and clinical applications of EPR. Gareth displayed the importance of instrumentation to the development of EPR, not restricted to the past 30 years.

While eventually the direct roles of Sandy and Gareth decreased (but certainly not vanished!), and others have taken on more and more responsibility, their impact has continued as many of these have been scientists that they trained. Gareth and Sandy also have continued to play prominent roles, usually in the background, but always providing key input and assurance of continuity. Particularly important is that Sandy has continued as treasurer of the Symposium, doing all of the work to keep the Symposium solvent and legal. There is now a formal, self-perpetuating, group to organize the EPR Symposium.

Beyond the science per se, Gareth and Sandy also have facilitated important social changes in meetings. After trying special sessions for young investigators, which inadvertently resulted in decreased attention of senior scientists, the Symposium now includes students and other young investigators in the regular lecture sequence. With the strong encouragement of the Eatons, a much larger number of female scientists participate than in the early years of the Symposium. As posters became more common in scientific meetings, they added a strong emphasis on poster presentations, which now are a major emphasis of the Denver Symposia. Posters are on display for the full length of the Symposium, with two scheduled sessions for formal presentation that always continue past the scheduled time, because of the intense discussions around the posters. An important feature that advances the future of the field is for the poster sessions to include undergraduate students. Awards for best posters honor the student presenters. There has been a major turnover of contributors to the poster sessions, many whose contributions were first presented in the poster sessions now are among the leaders in the field of EPR. Figure 3 shows some of the aspects of the Poster sessions.

1.1 Sponsors and the EPR Symposia

Gareth and Sandy, from the beginning, recognized that no conference can succeed without sponsors. The role of the sponsors has been very successfully interwoven into the organization of the EPR Symposium. The sponsors benefit from learning what the users are interested in being able to do and the participants benefit from being able to learn about what is available commercially and perhaps shape the future development of equipment. Although Bruker has been a major and continuing presence, many other companies and entities also have contributed very significantly.

The major sponsors over the years have included:

- 1979 Bruker. Varian and JEOL
- 1980–1987 Varian, IBM/Bruker
- 1988–2001 Bruker
- 2002–recent years
    - Avanti Polar Lipids
    - Bruker
    - Jules Stein Professorship Endowment

Fig. 3 Views taken at Poster Sessions at the EPR symposia at Denver

- Medinox Specialties
- National High Magnetic Field Lab
- Scientific Software Service
- Virginia Diodes

- Many others have also made very valuable contributions to the meeting, some a few times, others only once.

  - Bridge 12 Technologies
  - Centers for Disease Control
  - Clin-EPR, LLC
  - Department of Energy
  - Digilab
  - Element 6
  - JEOL
  - LakeShore Cryotronics
  - MicroNow Enterprises
  - Norell
  - OMRF Spin Trap Source
  - Research Specialties
  - US EPR, Inc.
  - Wilmad Glass

The Bruker BioSpin EPR User Meeting often has been an important starting event for the EPR Symposium, where Bruker updates the community on new instrumentation developments, and shows applications that stimulate ideas of experiments made possible by the new instruments. When the meeting is in Denver, there is an Open House with demonstrations in the Eaton lab. In both cases, a tradition of great snacks and stimulating beverages has added to the enjoyment of the participants and stimulated interactions among participants that often pay scientific dividends.

1.2 Bruker New Product Introductions

Many significant new products from Bruker have been introduced to the community at the EPR Symposium (Fig. 4).

Some of the new Bruker product introductions at the "Denver meeting" were:

- 1987 ESP380 X-band pulse
- 1996 E680 W-band pulse
- 2001 Xepr on Linux;

  ER 4123D dielectric resonator for spin labels
- 2002 superQFT Q-band pulse
- 2003 Transient system
- 2004 L-band imaging system
- 2005 EMXplus
- 2006 EMXmicro and EMXplus;

  6T EPR supercon magnet; SpecJet II;
  L-Band pulse bridge
- 2007 New superconducting magnet; S-band pulse; Molecular Sophe

Fig. 4 Bruker introduction of the Elexsys W-band system, complete with energized magnet in a downtown hotel ballroom.

- In 2019, Bruker announced the X-band rapid scan accessory, and demonstrated it in operation on an E580 in the Eaton lab

1.3 Celebrations of Outstanding Scientists, Awards, and Anniversaries

These have become an enjoyable and productive part of the interactions among the members of the EPR community. Figure 5 presents Mel Klein, 1991 is one of the outstanding scientists who was a regular contributor to the Denver Symposium and an example of participants who have generated multiple generations of students who have come to the Symposium.

When Clyde Hutchison was honored in 1991, the members of the clan that gathered included former students Art Heiss and Ralph Weber who have been important contributors to Bruker and helped facilitate academic-commercial collaboration (Fig. 6).

Jim is shown with another very highly respected scientist, Helmut Beinert who is giving him a rabbit because of Jim's unusual hobby of raising rabbits (Figs. 7, 8).

2 Workshops

Gareth tells an interesting story about the first Workshop in which they had a major role, which was on the future of EPR. Gareth was riding in a taxi in New York City with NIH program officer Carolyn Holliday, who was known to many people

Fig. 5 Mel Klein, at the EPR Symposium in 1991

Fig. 6 Clyde Hutchison and colleagues, 1991

Fig. 7 Celebration of Jim Hyde's 70th birthday, 2002

Fig. 8 Celebration of Hal Swartz's 70th birthday, 2005

in EPR. She commented that people in science should put more effort into thinking about the future of their field of research. He said that many of us were having informal discussions about the future of EPR. She asked, "why not a formal discussion with a report?" He replied the only way one would to an NIH official "money." She immediately asked for a budget, approved it, and before the taxi ride was over

the 1987 Workshop on the Future of EPR was planned. Five years later they had to submit a formal grant proposal for the second Workshop on the future of EPR. The 1987 and 1992 Workshops resulted in the following publications:

1. The Future of EPR Instrumentation, G. R. Eaton and S. S. Eaton, *Spectroscopy* **3**, 34-36 (1988).
2. Workshop on the Future of EPR (ESR) Instrumentation - Denver, Colorado, August 7, 1987, G. R. Eaton and S. S. Eaton, *Bull. Magn. Reson.* **10**, 3-21 (1988).
3. The Future of Electron Paramagnetic Resonance Spectroscopy, S. S. Eaton and G. R. Eaton, *Spectroscopy*, **8** 20-27 (1993).

The following list covers most of the workshops at Denver. Bruker offered to jointly sponsor with the University of Denver a series of topical Workshops to help people exploit the capabilities of modern EPR spectrometers. Extensive brochures were prepared for each of these workshops.

- 1987 Workshop on the Future of EPR
- 1992 Workshop on the Future of EPR
- 1999 First Pulsed EPR Workshop
- 2000 Workshop on Pulsed EPR
- 2001 Multifrequency EPR Workshop
- 2002 Workshop on EPR of Aqueous Samples
- 2003 Workshop on Measuring Electron-Electron Distances by EPR
- 2004 Workshop on EPR Imaging
- 2005 Workshop on Selecting an EPR Resonator
- 2006 Workshop on Computation of EPR Parameters and Spectra
- 2008 Workshop on Quantitative EPR
- 2013 Workshop on Rapid Scan EPR
- 2016 Workshop on Shaped Pulses

It should also be noted that although not covered here in detail, in the same spirit as the Denver conferences, Gareth and Sandy have participated and often helped with the organization of workshops at the EPR Centers in Milwaukee, University of Illinois, Chicago, and Dartmouth as well as international meetings.

3 International EPR Society

For many years, the principal international meetings on EPR were part of organizations that covered NMR as well. In view of the discrepant size of the two fields, these meetings were necessarily dominated by NMR scientists. In spite of good intentions, the resulting programs were often disappointing to the EPR scientists. The EPR Symposium had been going for a dozen years when people started thinking seriously that the EPR community might be better served by having their own professional society. Consequently, the International EPR (ESR)

Society was formally created at the 12th International EPR Symposium in 1989, but the real genesis might be traced to the 1987 Workshop on the Future of EPR, which was held in conjunction with the 10th International EPR Denver Symposium. Although the EPR Symposium had brought people together to share excitement about new developments in EPR for a decade already, it was in the 1987 Workshop that people came together to think collectively about the future of EPR, what the potential applications were, what the impediments to progress were, and what the enabling technologies might be. Importantly, people from Bruker, Wilmad, Oxford Instruments, and other companies joined with academic, industrial, and government lab scientists from many countries to solve problems together. After that Workshop, people began to perceive that we really were a society of researchers, and maybe we should formally create a society. Having made the largest noise about the need to have an EPR Society, I agreed to be the first President of the Society. Gareth and Sandy were asked to participate as secretary and treasurer. To avoid having the female automatically be the secretary, Gareth became secretary and Sandy became treasurer. Immediately, the question of a journal was raised. By that time, Kev Salikhov was hard at work founding Applied Magnetic Resonance, which, together with Journal of Magnetic Resonance and Organic Magnetic Resonance, met the perceived need for journals for EPR scientists to present their fundamental EPR findings, and therefore it was decided that there would not be a new journal for the proposed Society. However, a newsletter seemed to be needed. The benefit of a newsletter for EPR had already been demonstrated by the EPR Centers Newsletter, which was edited by Linn Belford, who agreed to convert it to the IES Newsletter and continue as editor. Over the years, this has grown to the present very valuable Newsletter, with international contributors. For many years, the International EPR Symposium in Denver allocated time in the program for an annual meeting of the Society. While deliberately the EPR Society tried to conduct its annual meeting at other sites, more often than not the Denver Meeting fulfilled this function.

From the beginning, we worried that with three Americans as officers, and having annual meetings at the Symposium in Denver would cause others to think of the Society as a US society, although we all wanted it to be the society for people in all countries. To counter this impression I and subsequent presidents put a lot of effort into involving scientists from many countries in the society and in linking to existing regional EPR Societies in other countries or regions of the world. There were many currency problems inhibiting international membership in the early years of the Society, so one of the roles of the Associated Societies and regional officers was to coordinate membership, collect dues, and distribute the Newsletter in those regions. Many years and editors later, it has become a very professional newsletter under the excellent guidance of Laila Mosina in Kazan. Many corporate and other donors, and much volunteer effort, keep the Newsletter and the Society strong. This was often done in collaboration with the Denver meeting. For example, Bruker has financed the distribution of the Newsletter to the benefit of all members of the Society.

In retrospect, the long-term success of the EPR Society has been advanced by the critical organizational and intellectual contributions of Gareth and Sandy and the communications that occurred via the Denver meetings. 2019 was the 30th year of

the International EPR Society, and the 75th anniversary of the discovery of EPR and appropriately, it was celebrated as part of the 42nd Denver Symposium.

4 Summary and Conclusions

The EPR field owes an immense gratitude to Gareth and Sandy for their many contributions at all levels. This summary touches upon 3 specific areas in which they have made very significant contributions, but this should not be interpreted as diminishing their very valuable contributions in many other aspects of EPR as well, especially in their scientific achievements.