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SE CONNAÎTRE, S'ENTENDRE, S'ENTRAIDER

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If you would like to become a member of the AMPERE Group, you can register online under: **www.ampere-society.org**

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Editorial

Dear AMPERE colleagues,

Hopefully you are enjoying a nice summer with stimulating conferences, more time for research than during semesters or busier times at your company and, last but not least, vacations that open up new perspectives. Speaking of stimulating conferences, in my opinion the 2016 EUROMAR Conference in Aarhus was on a spectacular level in all respects, quality of the scientific contributions, balance between fields, and venue. Organisation was so smooth that one hardly noticed it and Thomas Vosegaard made the impression as if it was effortless. Now, we know that a big effort was involved and like to thank Thomas, his team, and the Scientific Committee for putting this memorable event together. And, by the way, if you missed the conference, you also missed the Molecular Cuisine conference dinner at the university campus of Aarhus and the first lecture ever on the menu of a conference dinner. Whether or not you attended in Aarhus, I am looking forward to seeing you next year in Warsaw.

In Aarhus, Groupement AMPERE adapted its statutes and reinitialized the AMPERE Committee. In the current small Committee, some European countries are not represented and a broader representation of subfields would also be good. We plan to extend the Committee gradually over the next three years and we are looking for active scientists who want to take part in steering and organizing activities of the European magnetic resonance community. Nominations are welcome.

Also in Aarhus, the first meeting of the new AMPERE subdivision for Hyperpolarization took place and the new Youth School/Conference "SPINUS" organized by V. Chizhik in St. Petersburg was named an AMPERE event. Welcome aboard!

Now, supposing that you sit in the shadow at a beach or in a mountain hut after a long day of hiking (or cycling), you may want to pass time with an interesting read. How about the portrait interview of Richard Ernst or the historical account on the first NMR experiments ever done on biological tissues, shortly after Felix Bloch had declared his spectrometer a tool for pure physics and off limits for physiology, medicine, and biology? You will find these articles and a portray of the Division of Spatially Resolved Magnetic Resonance in this issue.

Gunnar Jeschke
Secretary General of Groupement AMPERE

Portrait: Richard R. Ernst

• why magnetic resonance and why NMR and MRI?
Nature has built into almost all materials and beings, sensors, nuclear spies that can reveal to us the secrets behind natural phenomena based on the principles of Nuclear Magnetic Resonance. These are encoded messages.

• what is your favorite frequency?
The higher the frequency the more sensitive will be its detection. But if it is too high, it has difficulties to penetrate dense materials or living beings.

• what do you still not understand?
I have still great difficulties to understand what ‚life' and how living material are different from ‚dead material'. And I have still great difficulties to understand human feelings, such as empathy and love.

• luckiest experiment you have ever done?
It is certainly the Fourier Transform Experiment that became the basis of all kinds of spectroscopies.

• what was the worst mistake you have made during your lab time?
My life consists of ‚trial and error'. Both belong to my existentia. I do not know which error is my greatest one. Perhaps, my greatest error is believing that there are solutions to my primordial questions.

• most memorable conference story?
It is connected to my very first lecture on Fourier spectroscopy in Asilomar in the 1960ies.

• with whom (historical person) would you like to meet?
Certainly the greatest scientist in the past century was Albert Einstein. He was also a kind person.

• when do you get your best ideas?
After a long and lively discussion with friends understanding what I have in mind.

• if you had just one month time for travelling - where would you go to?
I like to travel to one of the mysterious valleys in the Himalaya with many still uncovered secrets.

• your idea of happiness?
Having made a number of immortal discoveries that have changed the world around.

Prof. Dr. Richard R. Ernst
http://www.richard-r-ernst.ch

Position:	Richard R. Ernst was full Professor of Physical Chemistry at ETH Zurich since 1976 and retired in 1998. Today he is involved in studies and conservation of Central Asian paintings and is giving numerous lectures on the societal responsibility of scientists and teachers.
Education:	1962 Promotion on NMR in physical chemistry at ETH Zurich 1963 to 1968 research chemist in Palo Alto 1976 full Professor at ETH Zurich
Main Awards:	1991 Nobel Prize for Chemistry and Wolf Prize for Chemistry

Presenting the Division of Spatially Resolved Magnetic Resonance of the AMPERE Society

In 1991, the first International Conference on Magnetic Resonance Microscopy (ICMRM) was organized in Heidelberg, Germany. Since then this „Heidelberg Conference" was held in Germany (Heidelberg, 1993 and 1999; Würzburg, 1995; Aachen, 2007; Munich, 2015), USA (Albuquerque, NM, 1997; Snowbird, UT, 2003; West Yellowstone, MT, 2009), UK (Nottingham, 2001; Cambridge, 2013), Japan (Utsonomiya, 2005), and China (Changping/Beiging, 2011). In 1995, the Division of Spatially Resolved Magnetic Resonance (SRMR) of the AMPERE Society was founded and, starting with the 3rd ICMRM held in Würzburg in 1995, the meeting has become the biennial AMPERE event organized under the auspices of the SRMR Division.

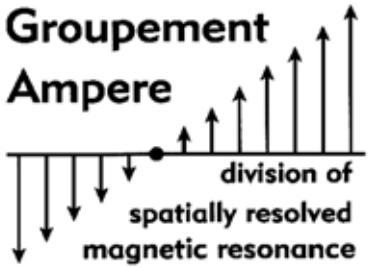
The governing organization of the Division consists of the Executive Committee, the Division Committee, and the General Membership composed of ICMRM meeting attendees who are automatically members of the AMPERE Society. The Division Committee is responsible for carrying out the business of the Division, including the scientific organization of the conference. The Executive Committee is responsible for the management, administration, and finances of the Division. The General Meeting has the final authority of the Division and takes place during ICMRM conferences with all participants as the members of the General Meeting.

The primary role of the Division is to advance the subject of Spatially Resolved Magnetic Resonance by means of the International Conference organized biennially across the world. The ICMRM meetings are devoted to the latest developments in the methods, equipment, and applications of spatially resolved NMR. The programs of the latest conferences traditionally include (but are not limited to) such topics as NMR hardware, biomedical NMR, NMR microscopy, engineering and materials, hyperpolarization, exotic and emerging NMR, flow and diffusion, low-field NMR, and "Colloquium on Mobile NMR" (CMMR). The conference also aims at enhancing personal communications between industry and academia, and between researchers from countries spanning the globe. The Executive Committee of the SRMR Division strives to ultimately rotate the ICMRM venue between Europe, North America and Asia in order to further the aim of international understanding and cooperation.

The ICMRM meetings have regularly attracted 160-190 participants and even more - the latest ICMRM in Munich in 2015 gathered together over 200 attendees. The scientific part of the ICMRM is commonly preceded by an educational/tutorial session. The program invariably includes the Young investigators' session during which the preselected finalists give oral presentations and compete for the Young investigators' award. Since the ICMRM12 meeting which took place in Cambridge in 2013, the award is named the Sir Paul Callaghan Young Investigators Award, in memory of the scientific contributions of one of the leading scientists in this field, and his infectious enthusiasm and keen interest in the research and scientific careers of young scholars, many of whom now play integral and leading roles in the research presented at ICMRM and beyond.

Based on the research presented and discussed at the ICMRM, three edited books were published so far: Magnetic Resonance Microscopy: Methods and Applications in Materials Science, Agriculture and Biomedicine, B. Blümich and W. Kuhn, Eds, VCH, 1992; Spatially Resolved Magnetic Resonance: Methods, Materials, Medicine, Biology, Rheology, Geology, Ecology, Hardware, P. Blümler, B. Blümich, R. Botto, and E. Fukushima, Eds., Wiley-VCH, 1998; Magnetic Resonance Microscopy, S.L. Codd and J.D. Seymour, Eds., Wiley-VCH, 2009. These books summarize nicely and thoroughly the developments and advances in the field of spatially resolved magnetic resonance with regard to novel techniques, hardware and applications in a broad range of scientific disciplines.

In 2009 during the ICMRM10 held in West Yellowstone, MT, USA, the image beauty competition was born as a new esthetically appealing feature which ever since emphasizes the fact that MR imaging is not only science but also an art.
Further information about the SRMR Division can be found on its webpage: www.icmrm.org, which in particular provides a link to the upcoming ICMRM meeting, to be held in 2017 in Halifax, Nova Scotia, Canada.



The First Study of Cartilage by Magnetic Resonance: A Historical Account

Yang Xia, Okland University and Peter Stilbs, Royal Institute of Technology

Abstract

Objective. To recap the historical journey leading to the *first* cartilage research article using nuclear magnetic resonance (NMR), published in 1955 by 2 Swedish researchers, Erik Odeblad and Gunnar Lindström. *Design*. Extensive Internet search utilizing both English and Swedish websites, and reading the dissertations available at the Royal Institute of Technology (Stockholm, Sweden) and via interlibrary loans at Oakland University (Michigan, USA). *Results*. Using a primitive NMR instrument that Lindström built for his graduate research at the Nobel Institute for Physics (Stockholm, Sweden), Odeblad and Lindström studied the characteristics of the NMR signal in calf cartilage. The authors wrote, "In cartilage and fibrous tissue, in which the proton signals probably arise from highly viscous water with short spin-lattice relaxation time, the signals were also larger than would correspond to the water content." The authors speculated the signal differences between water and biological tissues could be attributed to the absorption and organization of the water molecules to the proteins in the tissue, which was remarkably accurate. *Conclusions*. It is quite certain that Odeblad and Lindström published the first biomedical study using NMR in 1955. In this article, cartilage and a number of other biological tissues were examined for the first time using NMR.

Introduction

To find out who actually achieved a first in science and technology is not an easy task; sometimes, the conclusion can be controversial. Even more difficult is, many years after the events, ascertaining the background and journey that led those pioneers to carry out those first studies. The field of study discussed in this historical account is the study of cartilage by magnetic resonance. The technology of magnetic resonance has several acronyms as well as subfields, for example, nuclear magnetic resonance (NMR), which is the original and full name; NMR spectroscopy, which is the spectroscopic version of NMR (without spatial resolution) and commonly used in basic science, in particular, chemistry; NMR imaging, which is the imaging version of NMR and used mainly by nonmedical imaging scientists; magnetic resonance imaging (MRI), which is identical to NMR imaging, mainly used in the medical community; and μMRI or NMR microscopy, which is the high-resolution version of MRI.

The Journey to the First NMR Study of Cartilage

Erik Odeblad and Gunnar Lindström published a paper in 1955 in the journal Acta Radiologica, titled "Some preliminary observations on the proton magnetic resonance in biologic samples,"[1] in which cartilage (and some other biological tissues) was studied using NMR. Their research journey at one time intersected with a group of scientists (Bloch, Hansen, Packard[2]) who discovered NMR in 1946. Felix Bloch shared the 1952 Noble Prize in Physics with Edward M. Purcell[3] for their discovery of NMR.

Figure 1 shows a photo of Bloch in his laboratory during the 1950s, where the machines, no matter how primitive by today's standard, were extremely complicated and required lots of skills and experience to properly use.

Erik Odeblad was born in Kristinehamn, Sweden on January 31, 1922. He studied medicine at the Karolinska Institute (Stockholm, Sweden) and received his medical license in 1952. His medical education dissertation was on ovarian phosphate metabolism. In fact, gynecology had been his research interest throughout his entire medical career. Soon after the completion of his medical education, instead of practicing medicine, he became a Rockefeller Foundation Fellow and spent 1953 at the University of California, Berkeley, to learn advanced technologies that he could use in his medical research. One technology he wanted to learn during his fellowship was NMR. Since Sweden is the home for the annual Nobel Prize Award Ceremonies, it is likely that Erik Odeblad had heard about this new physics phenomenon in the previous year during the Nobel Prize Award announcement for NMR.

Figure 1. Felix Bloch in his laboratory in the 1950s.

Image source:
https://commons.wikimedia.org/wiki/File:Felix_Bloch_1950s.jpg

Stanford University, in California, was where Felix Bloch worked at the time. According to the writings of Dr. Peter A. Rinck[4] (a professor of diagnostic imaging who writes regularly at AuntMinnieEurope.com),

‚In Stanford, on the other side of San Francisco Bay, he (Erik Odeblad) met Felix Bloch. Odeblad asked him whether he could use his NMR spectrometer to study human samples, but Bloch's response was negative. He made it clear that NMR was a tool for physicists, not for research into physiology, medicine, or biology.'

Given the tools and equipment available for NMR at the time (**Figure 1**), such refusal was understandable. Without extensive training in experimental physics and electronics, no one would be able to operate such a primitive but complex system. So, Erik Odeblad did not accomplish his first goal during his fellowship.

Now we need to go back further for nearly 20 years, to 1936, when the Swedish Government appointed Dr. Manne Siegbahn (1886-1978) as a professor of experimental physics and the director of a new physics institute. The English name of the new institute was the Nobel Institute for Physics. Dr. Siegbahn received a Nobel Prize in Physics in 1924 for his research on x-ray spectroscopy. In 1937, Dr. Siegbahn and his institute moved into a new building in Stockholm.[5] Much of the research in the institute was in the field of nuclear physics with the use of particle accelerators and cyclotrons. Dr. Siegbahn had a son named Kai Siegbahn (1918-2007), who was also a physicist working at the same institute for some time and who also received a Nobel Prize in Physics in 1981 for his research in laser spectroscopy (commonly called x-ray photoelectron spectroscopy in modern literature). The trajectories of both Siegbahns intertwined with these of Erik Odeblad and Gunnar Lindström. Siegbahn senior was the Director of the Nobel Institute for Physics where Gunnar Lindström worked as a physicist; Dr. Manne Siegbahn was also the supervisor for Erik Odeblad's PhD dissertation on the topic of NMR research in 1966. Siegbahn junior had considerable input into the dissertation work of both Lindström and Odeblad; Dr. Kai Siegbahn was also the Chair and Professor of the Physics Department at University of Uppsala (Sweden) when Odeblad received his PhD in physics in 1966.

Gunnar Lindström (1918-1990)[6] studied at Chalmers University of Technology, where he graduated in 1943. He worked from 1945 to 1954 at the Nobel Institute for Physics. During his time at the institute, he completed a PhD dissertation in physics in 1952, titled "Nuclear Resonance Absorption Applied to Precise Measurements of Nuclear Magnetic Moments and the Establishment of an Absolute Energy Scale in β-Spectroscopy." **Figure 2** shows the NMR machine used in his research. Apparently, the NMR machine that Lindström built by himself, for his PhD dissertation, had an incredibly homogeneous magnet at that time, which even allowed him to measure the proton chemical shifts of mineral oil. (It is commonly accepted that the work of Arnold, Dharmatti, and Packard[7] in 1951 demonstrated the first proton chemical shift in ethanol by NMR.)

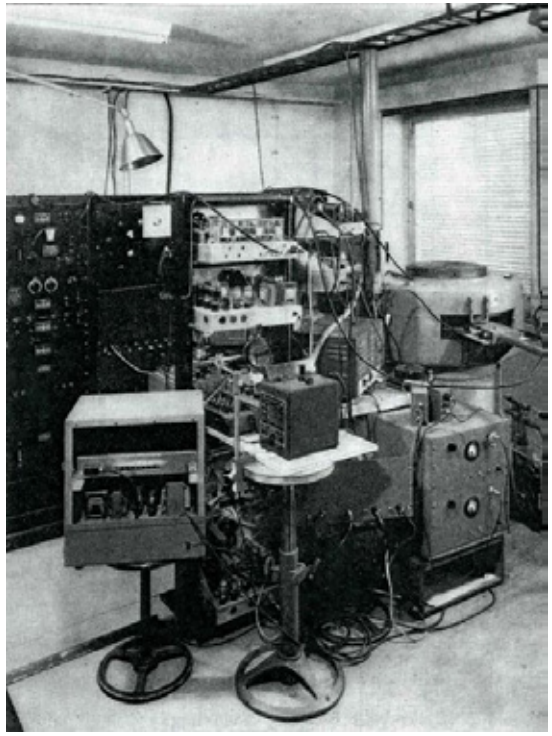


Figure 2. The nuclear magnetic resonance (NMR) instrument used in Lindström's dissertation research.

Image source: Page 16 of Lindström's 1952 PhD dissertation, which was included in „Arkiv för Fysik, Bd 4, Nr. 1."

Having been refused access to the Stanford NMR machine by Bloch, Erik Odeblad returned to Sweden in 1954 without getting any NMR experiments done during his fellowship. However, he soon must have come to know of Gunnar Lindström, with whom he started to study biological tissues using the NMR machine that Lindström had built for his dissertation work. (Note that there was no commercial NMR machine for sale at the time.) In December 16, 1954, Odeblad and Lindström submitted their first NMR research for publication.[1]

The Erik Odeblad and Gunnar Lindström 1955 Article

The early 1950s NMR machines had no fast Fourier transform (the modern version of which was invented 10 years later in 1966 by Cooley and Tukey). The experiment in these early machines would run by slowly sweeping the magnetic field to observe the resonance peaks. Two proton signals would appear for each specimen under the sweeping magnetic field, as shown in the article.[1] Studies of a number of biological tissues were reported in this article, including liver, muscle, fat, corpus vitreum, fibrous tissue, tendon, and cartilage. One reached a conclusion by comparing the signal of pure water with the signal of a nonwater sample. A number of differences can be found between the water signal and the tissue signal. For example, the authors wrote that "The proton signals in yeast were lower and somewhat broader than in pure water."

Tables 1 and **2** contain, respectively, the measurement of the proton signals and the T1 relaxation times in cartilage. The authors stated, "In cartilage and fibrous tissue, in which the proton signals probably arise from highly viscous water with short spin-lattice relaxation time, the signals were also larger than would correspond to the water content." The authors speculated that the signal differences between water and biological tissues could be attributed to the absorption and organization of the water molecules to the proteins in the tissue, which was remarkably accurate.

Table 1. Characteristics of the Nuclear Magnetic Resonance Signals.

Sample	Relative Area of the Signal	Error in the Area	No. of Measurements	Normalized Signal Area	Water Content
Distilled water	22	4	4	100	200
Calf Cartilage	26	3	6	118	53

Table 2. T_1 Relaxation Times.

Sample	TI (Seconds)	Estimate Error	No. of Measurements
Distilled Water	1.9	0.4	5
Calf Cartilage	<0.8	0.2	4

Erik Odeblad's 1966 PhD Dissertation

Apparently, Gunnar Lindström left academia for industry in 1954, shortly after the completion of these experiments. It is unclear if there were any additional NMR studies of cartilage by Dr. Odeblad. Keep in mind that Dr. Odeblad's research interest was always in reproductive biology. However, Odeblad must have gained sufficient knowledge in building the NMR machine during his collaboration with Dr. Lindström. In addition to using Gunnar Lindström's instrument, he started to build his own NMR system in the hospital he worked for as a physician (the Isotope Laboratory, Department of Gynecology, Sabbatsberg Hospital Stockholm, Sweden). In fact, throughout his time, Odeblad built 3 NMR machines, with magnetic fields of 0.4 T, 1.1 T, and 3.9 T.[8]

In 1966, Erik Odeblad received his PhD in physics under the supervision of Dr. Manne Siegbahn from the University of Uppsala (Sweden), where Dr. Kai Siegbahn was the Professor and Chair (the same position that his father Dr. Manne Siegbahn had in the past). Erik Odeblad's PhD dissertation can still be found in the Physics Department of the Royal Institute of Technology (KTH), Sweden. His PhD thesis, titled "Micro-NMR in High Field Permanent Magnetic Fields—Theoretical and Experimental Investigations with an Application to the Secretions from Single Glandular Units in the Human Uterine Cervix." The dissertation has 188 pages, containing a large portion in NMR instrumentation (chapters 1 to 12, pp. 12-119) and a small portion in biological experiments (chapters 13 to 15, pp 120-154). In the preface, Odeblad acknowledged and thanked the initial contributions of Gunnar Lindström in 1954. **Figure 3** shows the magnet of his NMR machine (from his PhD dissertation). Note that his new magnet looked very different from the magnet in Gunnar Lindström's instrument shown in **Figure 2.**

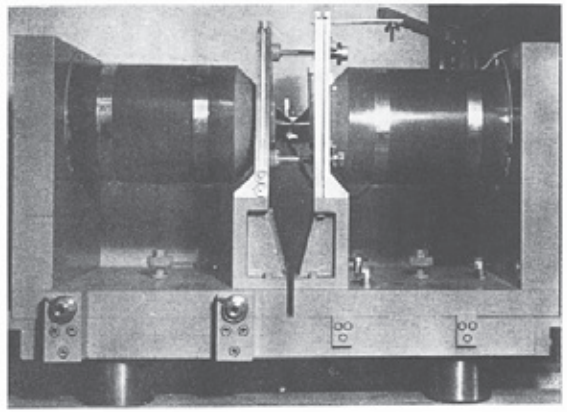


Figure 3. The nuclear magnetic resonance (NMR) magnet in Erik Odeblad's PhD dissertation.

Image source: Page 68 of Odeblad's 1966 PhD dissertation, which can be accessed from the Physics Department, KTH, Stockholm, Sweden.

Final Remarks

Gunnar Lindström left the Nobel Institute for Physics in 1954 to lead a technical division at SAAB, never realizing the historical significance of his work with Erik Odeblad in biomedical NMR and MRI. Lindström had a remarkable career in both academia (becoming a docent of nuclear physics and later a professor of electronic metrology at KTH in Stockholm) and industry (working with electronics and computer design, and nuclear power plant management). In particular, Lindström had a long career at SAAB, retired in 1974 as the Vice President of Saab-Scania, and was counted as the DataSaab's founder. There is actually a short movie online[9] of Gunnar Lindström describing the development of computers, in Swedish, of course.

Erik Odeblad had an incredible career - some might argue, 2 careers in 1 life. He was a gynecologist and interested in reproductive biology and medicine throughout his entire medical career. At the same time, he was the professor of medical biophysics at the University of Umeå from 1966 to 1988. His passion in research was using NMR to study reproductive biology. One of the last searchable news on the Internet is about Odeblad receiving the 2012 European Magnetic Resonance Award. **Figure 4** is a photo of Erik Odeblad during the award ceremony in 2012.

In conclusion, it is quite certain that Odeblad and Lindström published the first biomedical study involving the use of NMR. Here, cartilage and a number of other biological tissues were examined for the first time using NMR. This conclusion is further supported by the credit given by Paul Lauterbur in his 2003 Nobel lecture, for his invention of MRI that earned him and Peter Mansfield the Nobel Prize in Physiology or Medicine. Lauterbur said, "In an early predecessor to MRI, ..., and actual medical measurements were started when Erich Odeblad, a Swedish M.D., constructed apparatus and devised methods to study very small quantities of human secretions for medical purposes."[10] Of course, more details could be further discovered in this historical journey, for example, how Erik Odeblad came to be convinced that this seemingly obscure physics phenomenon could be used for his medical research, how he came to know Gunnar Lindström and persuaded him to measure these biological samples using NMR, and what kind of working dynamics was in their first biomedical research using NMR.

Figure 4. Erik Odeblad during the European Magnetic Resonance Award ceremony in 2012.

Photo source: Photo kindly provided by Dr. Peter A. Rinck (www. rinckside.org). Reproduced with permission.

Appendix

How Did We Find This Out?

Yang first came to know of the 1955 Erik Odeblad and Gunnar Lindström article in an unrelated communication with Konstantin Momot (Queensland University of Technology, Brisbane, Australia) in the summer of 2015, when he and Konstantin were coediting a book titled Biophysics and Biochemistry of Cartilage by NMR and MRI, to be published by the Royal Society of Chemistry in Cambridge, UK in 2016 (ISBN 978-1-78262-133-1). A few months later, Yang had time to search and download this 1955 article and became interested in reading more about these 2 pioneering authors. Internet research unearthed several pieces of related information, which were interesting but did not provide a full story. A few months later, Peter sent Yang an in-press review article[11] written by him, in which he kindly mentioned Yang's first article with Paul Callaghan and Craig Eccles[12] during the early days of diffusion imaging by NMR microscopy. In one of the subsequent emails among the 2 of them, Yang happened to mention his difficulties in finding out more information about Erik Odeblad and Gunnar Lindström. To Yang's astonishment, Peter had met Odeblad in 2006, when Odeblad was giving a lecture at KTH. Over the next several days, Peter sent Yang several pieces of very useful information, mainly by digging

through the Swedish articles on the Internet. With the additional information from Peter and also from Yang's further research, the story of the first cartilage study by NMR became complete and credible.

A moral to be learnt from this Internet digging experience is that the Internet searches in English would most likely just discover information in English; for information of foreign origins, you must search in the native language.

Acknowledgments and Funding

The authors thank Ms. Carol Searight (Oakland University) and Miss Aimee Xia for editorial comments on the manuscript. Yang Xia has been supported by the National Institutes of Health (USA) for his cartilage research since 1999 (four R01 grants AR045172 (1999-2012), AR052353 (2008-2016), AR069047 (2016-2021) from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS); Principal Investigator: Xia)

References

1. Odeblad E, Lindström G. Some preliminary observations on the proton magnetic resonance in biologic samples. Acta Radiol. 1955;43(6):469-76.
2. Bloch F, Hansen WW, Packard ME. Nuclear induction. Phys Rev 1946;69:127.
3. Purcell EM, Torrey HC, Pound RV. Resonance absorp- tion by nuclear magnetic moments in a solid. Phys Rev 1946;69:37-8.
4. Rinck PA. Europe celebrates the forgotten pioneer of MRI— Dr. Erik Odeblad. Rinckside. 2012;23(6):11-12. (Rinckside, ISSN 2364-3889 © 2012)
5. Nobel Institute for Physics. History. http://www.msl.se/ MSL_files/ history.htm. Accessed November 18, 2015.
6. Gunnar Lindström (professor). https://sv.wikipedia.org/wiki/ Gunnar_ Lindström_(professor). Accessed November 18, 2015.
7. Arnold JT, Dharmatti SS, Packard ME. Chemical effects on nuclear induction signals from organic compounds. J Chem Phys. 1951;19:507.
8. Acta Radiologica. Acta Radiologica 1921–2006. Acta Radiol 2008;49(Suppl. 434):6-18.
9. Thesecond(main)speakerintheYouTubemovie.https://www. youtube. com/watch?v=wn-ZsxTUevQ. Accessed November 18, 2015.
10. Lauterbur PC. Nobel Lecture, December 8, 2003. http://www. nobelprize.org/nobel_prizes/medicine/laureates/2003/lauter- bur-lecture. pdf. Accessed November 18, 2015.
11. Stilbs P. Historical: early multi-component FT-PGSE NMR self-diffusion measurements—some personal reflec- tions. Magn Reson Chem. Epub 2015 Oct 19. doi:10.1002/ mrc.4365.
12. Callaghan PT, Eccles CD, Xia Y. NMR microscopy of dynamic displacements: k-space and q-space imaging. J Phys E: Sci Instrum. 1988;21:820-2.

Minutes of the Meeting of the Ampere Bureau

in Aarhus, Denmark, on July 4, 2016

Members Present:
B. Blümich, B. Meier, G. Jeschke, L. Frydman, S. Jurga, M. Ernst,
G. Bodenhausen, A. Böckmann
Excused:
J. Dolinsek, C. Redfield

Agenda:

1. Approval of the minutes of the AMPERE Bureau meeting in Zurich April 1, 2016
2. Discussion on general financial policy of Groupement AMPERE (B. Blümich)
3. Preparation of Bureau and Committee elections (G. Jeschke)
4. Designation of Youth School-Conference "Magnetic resonance and its applications" ("Spinus"), Saint Petersburg (Russia) as an AMPERE event
5. Waiving membership fee for a guest committee member
6. Varia
7. Date of the next meeting (proposed shift to March 17th 2017)

At 18:55 hours G. Jeschke opened the meeting.

Ad 1. The minutes of the AMPERE Bureau meeting in Zurich, April 1, 2016, published in the AMPERE Bulletin 262, were approved unanimously.

Ad 2. The discussion about AMPERE finances was started by the request of the AMPERE Bureau that membership fees for participants of AMPERE events are collected as outlined in the updated AMPERE event guidelines. It is important that we are transparent about the finances and that the use of membership fees becomes better visible. The Groupement AMPERE has currently higher expenses than the annual income by membership fees (for details see the financial report of the Secretary General). To make this clearer, the presentation of the financial report will be changed to make a clearer distinction between the finances of the Groupement AMPERE, the Andrew Prize, and the subdivisions.
For the General Assembly it is important to stress the benefits of an AMPERE membership: discounted access to other AMPERE events, student stipends, and tutorials.

Ad 3. There was a discussion about the changes in the AMPERE statutes. Not all members of the Bureau agreed that term limits make sense since it will complicate finding people to serve on the Bureau. Since the proposed changes have already been published in the Bulletin, no further changes are possible. The AMPERE Committee has to vote first on the changed statutes and all further proceedings have to follow the changed statutes if they are approved. The second important point of the Committee meeting will be the election of the AMPERE Bureau according to the changed statutes (four year term, two consecutive terms possible). All members of the current Bureau agreed to run for reelections. The Bureau proposes to the AMPERE Committee a confirmation of the current members of the AMPERE Bureau in an open vote.
According to the new statutes, the AMPERE Committee has to be reelected (four year term, two consecutive terms possible) by the General Assembly. The AMPERE Bureau proposes to have a small number of people on the AMPERE Committee initially and to add more new members every year so that continuity in the AMPERE Committee is guaranteed. The AMPERE Bureau proposes the following initial members for the new AMPERE Committee: R. Boelens (NL), V. Chizhik (RUS), J. Dolinsek (SLO), J. Spevacek (CZ), M. Pons (ES), V.-V. Telkki (SF), D. Goldfarb (ISR), J. Banys (LIT), C. Thiele (D), I. Felli (I), S. Van Doorslaer (B), P. Giraudeau (F), S. Ashbrook (UK), W. Kozminski (PL). The AMPERE Bureau will ask for additional nominations for next year at the General Assembly. In addition, representatives of the national magnetic-resonance societies will be contacted and invited to become members of the AMPERE Committee.

Ad 4. The Youth School-Conference "Magnetic resonance and its applications" ("Spinus"), Saint Petersburg (Russia) organized by V. Chizhik would like to become an AMPERE event. The AMPERE Bureau approved this request.

Ad 5. The AMPERE Bureau approved waiving the membership fees of a retired guest AMPERE Committee member.

Ad. 6 Varia: There were no points discussed under Varia.

Ad 7. The date and time of the next annual meeting of the AMPERE Bureau was changed to Thursday, March 16, 2017 in Zurich at 11:00 hours.

At 20:20 hours G. Jeschke closed the meeting and thanked all the present members for their time and effort.
Aarhus, 4.7.2016, Matthias Ernst

Minutes of the Meeting of the Ampere Committee

in Aarhus, Denmark, on July 5, 2016

Members Present:
B. Blümich, B. Meier, G. Jeschke, L. Frydman, S. Jurga, M. Ernst, G. Bodenhausen, A. Böckmann, C. Redfield, I. Felli, J. Banys, V.-V. Telkki, J. Spevacek, C. Luchinat, M. Pons, D. Goldfarb
Excused:
Christoph Arns, Rolf Boelens, Pietro Carretta, Vladimir Chizhik, Janez Dolinsek

Agenda:
1. Approval of the Agenda
2. Approval of the minutes of the AMPERE Committee meeting in Zurich, July 2, 2014
3. Report of the president on the state of the AMPERE Society (B. Blümich)
4. Financial report of the secretary general (G. Jeschke)
5. Changes in the AMPERE Statutes and approval of the changed Statutes
6. Elections of executive officers and honorary members of the Bureau
7. Preparation of the election of AMPERE Committee members and honorary members by the GA
8. Varia

At 12:45 hours G. Jeschke opened the meeting.

Ad 1. The agenda was approved unanimously.

Ad 2. The minutes of the AMPERE Committee meeting in Zurich, July 2, 2014, published in the AMPERE Bulletin 254/255, were approved unanimously.

Ad 3. B. Blümich delivered his report on the state of the Groupement AMPERE. During the past two years, John Waugh and Endel Lippmaa passed away. John Waugh was an assiociated member and Endel Lippmaa a long-time regular member of the Groupement AMPERE and will be remembered. An obituary of Endel Lippmaa was printed in the Bulletin 258/259.

The AMPERE society is in good shape and G. Jeschke has made the AMPERE Bulletin more attractive to read and the new webpages are online. There is an increasing number of activities with two new subdivisions (Biological Solid-State NMR, Hyperpolarization in MR) being added to the AMPERE tree. The AMPERE Prize has changed to honor now an early-stage independent researcher to complement the Bruker-sponsored Richard Ernst prize for senior researchers. There is a large number of schools and conferences that are organized annually or biannually as AMPERE events with the EUROMAR being the largest magnetic-resonance conference in Europe. The procedures and guidelines for AMPERE events have been updated. The discount for AMPERE members and the inclusion of the membership fees for non members is now required for all AMPERE events and for a better awareness of the Groupement AMPERE (brand identity), the logo of AMPERE needs to be displayed on the webpage of the conferences and the AMPERE tree should be printed in the conference program.
The membership fees, either paid directly to AMPERE or through participation in an AMPERE event, entitle the members to a reduced rate at all AMPERE events. The fees are used to finance the operating costs of AMPERE and for student travel grants, awards, and tutorial sponsorship at conferences. The Bureau will try to make the distribution of the money more balanced and transparent. In addition, we also need some money as a reserve for unforeseen events. The Groupement AMPERE also provides accounts for the subdivisions to handle their finances.
The new statutes have to be voted on in the Committee meeting today. The main changes are the change of the name "Congress AMPERE" to "EUROMAR", term limits for the AMPERE Committee and AMPERE Bureau to four years with two consecutive terms allowed. By this the Bureau hopes to have a more balanced composition of the AMPERE Committee with all groups and countries being represented. In addition, the term "Executive Committee" was changed to "AMPERE Bureau".
There were no questions about the report of the president.

Ad 4. G. Jeschke gave an overview (see p. 20) over the finances of the Groupement AMPERE. The finances are good. For a better distinction between the finances of the Groupement AMPERE and the subdivisions, the presentation of the finances was changed to highlight this aspect. The financial report has to be approved by the general assembly. The AMPERE Committee accepted the report and the work of the whole Bureau during the past two years unanimously. It was decided to transfer the money for the past three Andrew prizes from the Andrew account into the general operating account of the Groupement AMPERE.

Financial Report of the Groupement Ampere

Fortune of the Society per June 21. 2016

Ampere Accounts	CHF	Euro
Savings Account	16‘820.25	
Current Account	1‘985.65	
Current Account Euro - *NEW*	4‘502.67	4‘139.73
Security Depot - *CLOSED*		
Savings Account Andrew	34‘017.45	
Security Depot Andrew	83‘310.69	
Total	**146‘636.71**	
Accounts of subdivisions		
NMR school (Ampere)	2‘169.11	1‘994.27
MRPM	24‘242.45	
Savings Account SMRM	35‘424.55	
Savings Account Euromar	71‘646.89	
Current Account Euromar	65‘600.55	60‘312.81
Hyperpolarization (past; DNP)	7‘337.65	
EPR	7‘418.40	
Food NMR	3‘649.30	
Biol. Solidstate NMR - *NEW*	6‘961.10	6‘400.00
Total	**224‘450.00**	
Grand Total	**CHF 371‘086.71**	

Ad 5. The AMPERE Committee approved the changes in the new statutes of the Groupement AMPERE unanimously without any abstentions.

Ad 6. The AMPERE Bureau proposes the reelection of all Bureau members and honorary members in their current offices. The AMPERE Committee followed the recommendation of the Bureau and all members and honorary members of the Bureau were reelected in an open vote. In addition to the elected members, also the past president (B.H. Meier) as well as one representative of each subdivision are ex officio members of the AMPERE Bureau. With this election, the new election terms (four years) and the term limits (two terms) start counting.

Ad 7. According to the new statutes, the AMPERE Committee has now to be elected by the General Assembly. The AMPERE Bureau suggests to start with a small number of Committee members (R. Boelens (NL), V. Chizhik (RUS), J. Dolinsek (SLO), J. Spevacek (CZ), M. Pons (ES), V.-V. Telkki (SF), D. Goldfarb (ISR), J. Banys (LIT), C. Thiele (D), I. Felli (I), S. Van Doorslaer (B), P. Giraudeau (F), S. Ashbrook (UK), W. Kozminski (PL)) which are now also subject to a four year term and a maximum of two consecutive terms. The Bureau proposes to add more people in the coming years and also to contact the national magnetic resonance societies for suggestions. Deficits in scientific fields and regional imbalances can then be adjusted. The AMPERE Committee agreed to this proposal which will be voted on in the General Assembly.

Ad 8. Varia: There were no points discussed under Varia.

At 13:20 hours G. Jeschke closed the meeting and thanked all the present Committee members for their time and effort.

Aarhus, 5.7.2016, Matthias Ernst

Minutes of the General Assembly of the Groupement Ampere

on July 6, 2016 in Aarhus, Denmark

Agenda:

1. Approval of the Agenda
2. Approval of the minutes of the AMPERE General Assembly in Zurich, July 2, 2014
3. Report of the president on the state of the AMPERE Society (B. Blümich)
4. Financial report of the secretary general (G. Jeschke)
5. Information about the election of the AMPERE Bureau.
6. Election of the AMPERE Committee members
7. Varia

At 18:45 hours G. Jeschke opened the meeting.

Ad 1. The agenda was approved unanimously.

Ad 2. The minutes of the AMPERE General Assembly in Zurich, July 2, 2014, published in the AMPERE Bulletin 254/255, were approved unanimously.

Ad 3. B. Blümich delivered his report on the state of the Groupement AMPERE. During the past two years, John Waugh and Endel Lippmaa passed away. John Waugh was an assiociated member and Endel Lippmaa a long-time regular meber of the Groupement AMPERE and will be remembered. An obituary of Endel Lippmaa was printed in the Bulletin 258/259.
The AMPERE society is in good shape and G. Jeschke has made the AMPERE Bulletin more attractive to read and the new webpages are online. There is an increasing number of activities with two new subdivisions (Biological Solid-State NMR, Hyperpolarization in MR) being added to the AMPERE tree. The AMPERE Prize has changed to honor now an early-stage independent researcher to complement the Bruker-sponsored Richard Ernst prize for senior researchers. There is a large number of schools and conferences that are organized annually or biannually as AMPERE events with the EUROMAR being the largest magnetic-resonance conference in Europe. The procedures and guidelines for AMPERE events have been updated.
The membership fees either paid directly to AMPERE or through participation in an AMPERE event entitle the members to a reduced rate at all AMPERE events. The fees are used to finance the operating costs of AMPERE and for student travel grants, awards, and tutorial sponsorship at conferences.

The Bureau will try to make the distribution of the money more balanced and transparent. In addition, we also need some money as a reserve for unforeseen events. The Groupement AMPERE also provides accounts for the subdivisions to handle their finances.
The new statutes have been approved in the AMPERE Committee meeting yesterday.
There were no questions about the report of the president.

Ad 4. G. Jeschke explained the finances of the Groupement AMPERE (see p. 20). The assembly approved the financial report unanimously with no abstentions.

Ad 5. The General Assembly was informed about the election of the AMPERE Bureau by the AMPERE Committee. All officers of the society were reelected. President is Bernhard Blümich with the two vice presidents Anja Böckmann (Lyon) and Janez Dolinsek (Ljubljana). Secretary general is Gunnar Jeschke (Zurich) and executive secretary Matthias Ernst (Zurich).

Ad 6. The AMPERE Bureau and the AMPERE Committee propose an initial list of 14 people for the new AMPERE Committee (R. Boelens (NL), V. Chizhik (RUS), J. Dolinsek (SLO), J. Spevacek (CZ), M. Pons (ES), V.-V. Telkki (SF), D. Goldfarb (ISR), J. Banys (LIT), C. Thiele (D), I. Felli (I), S. Van Doorslaer (B), P. Giraudeau (F), S. Ashbrook (UK), W. Kozminski (PL)) which has to be elected for four years with a maximum of two consecutive terms. The AMPERE Bureau asks all members to make proposals for additional AMPERE Committee members for the next General Assembly.
The AMPERE Committee was elected unanimously with no abstentions.

Ad 7. There were no points discussed under varia.

At 19:00 hours G. Jeschke closed the meeting and thanked all the present AMPERE members for their time and effort.

Aarhus, 6.7.2016, Matthias Ernst

Executive Officers and Honorary Members of the AMPERE Bureau

The AMPERE BUREAU includes the executive officers (which take the responsibility and the representation of the Groupement between the meeting of the committee), the honorary members of the Bureau and the organizers of forthcoming meetings.

Executive Officers 2016 - 2019

President	B. Blümich
Vice Presidents	J. Dolinšek A. Böckmann
Secretary General	G. Jeschke
Executive Secretary	M. Ernst
EF-EPR Representative	G. Smith
SRMR Representative	M. Johns
MRPM Representative	C. Arns
MR-FOOD Representative:	J. van Duynhoven
Hyperpolarisation Representative:	G. Bodenhausen
EUROMAR Representative	L. Frydman
EUROMAR Treasurer	C. Redfield
Past President	B.H. Meier
Honorary Member	H.W. Spiess
Honorary Member	St. Jurga

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Future conferences

Ampere events 2016

MRPM13	Bologna (Italy)	September 4-8 2016
Xth EFEPR	Torino (Italy)	September 4-8 2016
Ampere Biological Solid-State NMR School	Palma de Mallorca (Spain)	October 9-14 2016
MDMR 2016	Kazan (Russian Federation)	October 31 to November 4

2017

Euromar 2017	Warsaw (Poland)	July 2-6 2017
ICMRM	Halifax (Nova Scotia)	August 13-17 2017

Other events 2016

ICMRBS 2016	Kyoto (Japan)	August 21-26 2016
APES 2016	Irkutsk (Russia)	August 28 - Sept. 2, 2016
SciX2016	Minneapolis (USA)	September 18-23 2016

2017

20th ISMAR conference	Québec City (Canada)	July 23-28 2017
SciX2017	Reno (USA)	July 2-6 2017