Nantes, 6 juillet 2018

30ème Anniversaire du GERM

Journée Satellite de l'EUROMAR

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Cette journée a été organisée avec l'aide importante des organismes suivants :

Programme

08h30-08h50 – *Accueil*

08h50-09h00 – *Introduction de la journée*

09h00-09h30 – **Maurice Goldman**

09h30-10h00 – **Muriel Delepierre**

10h00-10h30 – **Daniel Canet**

10h30-11h00 – *Pause Café*

11h00-11h30 – **Gérald Remaud**

11h30-12h00 – **Luc Darrasse**

12h00-12h30 – **Dominique Massiot**

12h30-14h00 – *Déjeuner*

14h00-14h30 – *Assemblée Générale : renouvellement du Bureau*

14h30-15h00 – **Hervé Vezin**

15h00-15h30 – **Julien Valette**

15h30-16h00 – **Geoffrey Bodenhausen**

Liste des Résumés

9h00-9h30 - Maurice Goldman, Académie des sciences, Paris

The beginning of magnetic resonance in France as viewed from Abragam's « Laboratoire de Résonance Magnétique »

A few laboratories turned to magnetic resonance in France in the 50's and 60's. Among them, Anatole Abragam created in 1954 the « Laboratoire de Résonance Magnétique » at the Commissariat à l'Energie Atomique at Saclay, France, with Ionel Solomon and Jean Combrisson. This laboratory departed at the start from the others by its consideration of magnetic resonance as a domain of fundamental physics in itself as well as a tool for the study of fundamental condensed matter problems, following the position of the founders of NMR, the groups of Felix Bloch and of Edward Purcell. Chemistry was left aside for lack of competence (and of interest) by the founders of the laboratory. Much of the theoretical and experimental aspects of the domain of magnetic resonance had already been explored, but limited to those using the technical tools then available, that is without superconducting magnets, no solid-state electronics, no computers, no large memories for sampling, storing and processing the signals... and no word processors. Within these limitations, an astounding numbers of new fundamental tools and applications were developed through the world, and notably in the Saclay laboratory. So much so that when the author joined the laboratory of Dick Norberg in Saint Louis, Missouri for a sabbatical stay, he was introduced as a member of « the most productive group in the world ».
The talk will describe some of these aspects and achievements of what one might call « Paleomagnetic resonance », with but a hint at the explosion of novelties and applications in a domain repeatedly claimed to be as dead as « a dead horse ».

9h30-10h00 - Muriel Delepierre, CNRS, Institut Pasteur, Paris

RMN biologique et GERM

La naissance du GERM en 1977 a vu mes premiers pas dans le monde de la RMN. La première réunion à laquelle j'ai pu assister était en 1981 en Lorraine à l'Abbaye des Prémontrés à Pont-à-Mousson. Au cours de cet exposé je vais décrire l'évolution de la RMN biologique telle que je l'ai vécue depuis cette époque en insistant un peu sur la période 1994-1997, période au cours de laquelle j'ai siégé au bureau du GERM pour lequel j'ai ensuite assuré la présidence de 1996 à 1997. Je conclurai sur ma vision, forcement restreinte, de l'avenir de la RMN biologique.

10h30-11h00 - Daniel Canet, Université de Lorraine, Nancy

Le GERM avant le GERM

Si en cette année 2018 on célèbre le 30ème anniversaire de la création de l'association du GERM, ce « groupe d'étude en résonance magnétique » est né en 1977 avec une première réunion (GERM I) qui s'est tenue à Vichy. Les deux réunions suivantes, 1978 et 1979, se sont également tenues à Vichy. Le GERM a ensuite migré vers la Lorraine (Abbaye des Prémontrés à Pont-à-Mousson) pour les réunions de 1980 et 1981. A travers mes souvenirs et quelques documents que j'ai pu retrouver, j'essaierai de décrire la naissance de ce groupe, la façon dont se tenaient les réunions de bureau, le contenu et l'animation des rencontres scientifiques… Parallèlement, j'essaierai d'évoquer ce qu'étaient les grandes tendances et les développements que connaissait la RMN à cette époque.

11h00-11h30 – Gérald Remaud, Université de Nantes

From SNIF-NMR to isotopomics: 30 years of isotopic NMR on the example of vanillin

By introducing in the early 80's the concept of intramolecular deuterium profiles determined by quantitative ^{2}H NMR, Prof Mr and Mrs Martin, from the University of Nantes, revolutionized the approach for authenticating the origin of a product. Their research criteria were based on the following postulate: the existence of a non-statistical distribution of ^{2}H in the main molecules found in wine, could be demonstrated by ^{2}H NMR. Indeed, they successfully applied to a call of project from the French Ministry of Finance devoted to the design of a new analytical method for the quantification of the chaptalization of wine. In fact, the challenge was: the detection and quantitation of ethanol from beet sugar in ethanol from grape must (wine), yet it is the same chemical compound! Then, the methodology known as SNIF-NMR (Site-specific Natural Isotope Fractionation studied by Nuclear Magnetic Resonance) was applied on a series of products.
The Martin's successors have been continuing the development of isotopic NMR on ^{2}H but they took a decisive step 10 years ago by proposing isotopic ^{13}C NMR for the titration of each ^{13}C isotopomer of a given molecule. A new challenge was tackled: reaching a repeatability better than 0.1‰ in ^{13}C NMR at natural abundance! Key features for reaching the target precision of 1‰ include (i) homogeneity and robustness of the ^{1}H decoupling of by using appropriate adiabatic decoupling and (ii) the reduction of the experimental time via the reduction of the longitudinal relaxation time by using relaxation reagents. However, further fine-tuning and specific parameters (relaxation, line width, ^{13}C–^{13}C satellites, etc.) have to be established using elaborated NMR protocols, including an adiabatic INEPT pulse sequence for each new molecular probe so as to elucidating the isotopome.
The determination of the origin of vanillin for authenticate vanilla aroma illustrates the 'game' over 30 years between fraud and quality control: keeping one step ahead of the fraudster!

11h30-12h00 – Luc Darrasse, IR4M, Univ Paris-Sud, CNRS, Saclay

40 years of biomedical MRI: a quest for spatial resolution and sensitivity

In biomedical MR imaging, the spatial resolution is directly limited by the level of magnetization available in the tissues and the sensitivity of the corresponding signal measurement. Thus, image enhancement is particularly crucial with large samples and conductivity such as the human body. This presentation will review the various ways that have been explored to solve this issue since the early days of MRI, such as increasing the strength of the B_0 static magnetic field, increasing the sensitivity of RF coils or using magnetic or hyperpolarized contrast agents.

12h00-12h30 – Dominique Massiot, CEMHTI-CNRS UPR3079, Orléans

RMN des matériaux : Haute et très hautes températures, noyaux quadripolaires, imagerie et plus encore… l'histoire est riche de promesses

Sous ses différents aspects, la RMN appliquée aux matériaux n'a pas fini de se développer et d'offrir de nouvelles perspectives. Nous les mettrons en perspectives à partir d'exemples marquants en soulignant la variété des approches.

14h30-15h00 – Herve Vezin, LASIR, Lille

15h00-15h30 – Julien Valette, Commissariat à l'Energie Atomique, Saclay

Diffusion-weighted MRS in the brain: a long and tortuous path

Diffusion-weighted NMR spectroscopy *in vivo* (DW-MRS) offers the unique ability to non-invasively quantify the diffusion of endogenous brain metabolites. In contrast to water molecules as observed by diffusion-weighted MRI, most brain metabolites are confined into the intracellular space. Such cellular specificity has been the main motivation driving DW-MRS research over the last 25 years. Alterations of metabolite diffusion have been reported in brain diseases, illustrating the potential of the method. However, the origin of these variations has remained unclear. This is essentially due to the various potential factors which may *a priori* affect metabolite diffusion, such as cytosol viscosity, subcellular compartmentation, cellular morphology and even active transports.

Over the last years, technical and methodological developments allowed better characterizing metabolite diffusion properties over a broad range of diffusion-weightings and diffusion times, strongly suggesting that cellular morphology is by far the main feature governing observed metabolite diffusion. This yields solid grounds for correctly interpreting metabolite diffusion, and also opens possibilities to quantify some cell-specific structural parameters from DW-MRS, thus fostering renewed interest in DW-MRS.

As far as such things can be anticipated, the future of DW-MRS may reside in its capacity to provide more accurate and quantitative description of cellular compartments. This will presumably rely on advances in diffusion-encoding approaches (e.g. as developed for diffusion MRI), technical innovations (such as stronger gradients), and exploiting specific NMR properties of some metabolites to measure their diffusion at ultra-long time scales.

15h30-16h00 – Geoffrey Bodenhausen, ENS, Paris

Embarrassment of Riches

Time and again, NMR has been declared to be a dead discipline: all new methods are supposed to have come of age, all applications smack of déjà vu, all fertile meadows has been grazed to the roots, and all fontaines de jouvence have been exhausted. Yet, younger generations seem to show renewed interest. Why?

Although few will remember the French playwright Léonor Jean Christine Soulas d'Allainval, many will appreciate the title of his 1726 play “L'Embarras des richesses”, a title which in 1987 inspired a brilliant book by the British historian Simon Schama, “The Embarrassment of Riches: An Interpretation of Dutch Culture in the Golden Age.”

For us, humble members of the NMR community, we know what this means. Rich we are – not so much in terms of instrumentation, now that after synchrotrons and neutron spallation sources, even cryo-electron microscopes have overtaken NMR in this respect – but we are rich in terms of the sheer number of publications that we have produced collectively, in terms of the number of meetings that we must attend, in terms of the crushing wealth of theory (think of Rabi, Bloch, McConnell, Slichter, Redfield, Goldman, Waugh, Provotorov, Wenckebach, Ernst, Levitt, and many others who might be offended if they discover that they are left out.) Rich we are in terms of the sophistication of our instruments (think of our superconducting magnets with a homogeneity better than one part in a billion, think of our gyrotrons, think of samples spinning at rates well over 100 kHz…) Rich we are in the diversity of applications (think of la détection de la chaptalisation des vins which was developed in Nantes, the detection of invisible minor conformers of biomolecules, the measurement of confined diffusion in porous solids and in living cells…) Rich we are because of the societal relevance of our work (think of the screening of low-affinity drug fragments, of the impact of functional MRI on cognitive sciences ...)

Of course the younger generations are right to be fascinated!