



**IEEE
MAGNETICS**

NEWSLETTER

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Editor: Jia Yan Law



**Magnetotactic
Bacteria**



**Magnetic
Nanoparticles
for cardiovascular
diseases**

**In
Memory of**

- + Al Hoagland
- + Vitalij K. Pecharsky

**IEEE MagSoc
Summer
School's Journey:**

- + From Student to Director

**How to Maximize
Your Conference**

- + Experience

I Took My Leap

- + to Pursue My Goal In Science

and many more articles...



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Editor
Jia Yan Law

Associate Editorial Board
Martin Lonsky

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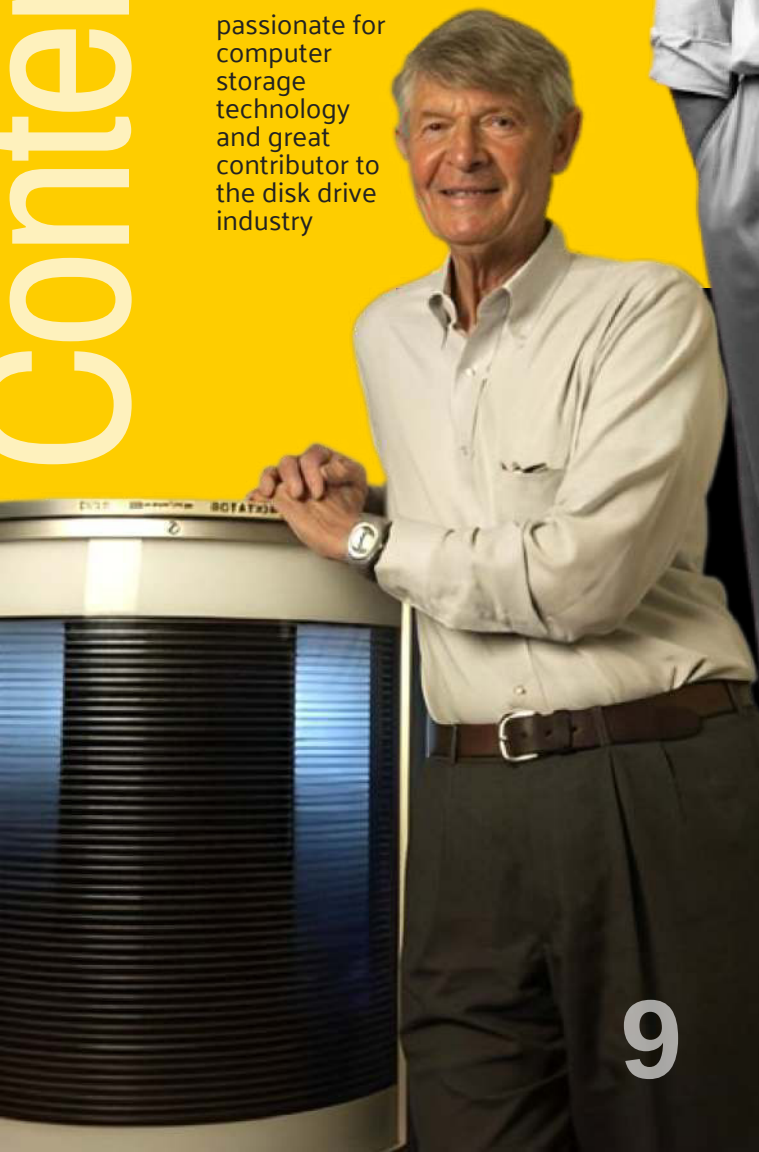
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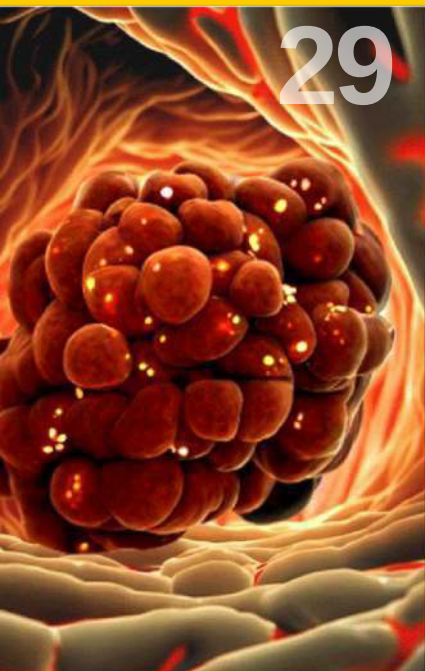
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From the President:
**Atsufumi
Hirohata**

Welcome to the May issue of our newsletter. Thanks to Jia Yan Law, our Newsletter Editor, together with the Publications and Publicity Committees' great efforts, we have received many positive feedback on the new look of our Newsletter. I hope this would offer a quick and efficient communication tool for the Society. Please feel free to contact Jia Yan or myself if you have any suggestions for further improvement.



First of all, I would like to announce good news about the additional allocation of approximately \$100k to our initiative budget.



Our budget consists of three parts.

First, 50% of the previous fiscal year's surplus will be allocated to our operational budget.

The second part is 1~1.5% of the reserve fund of the Society (3% of the money) is set aside for new initiatives.

The third part is a \$ 12k from the Magnetics Society's Diversity, Talent and Innovation Fund at the IEEE Foundation established by Pallavi Dhagat and Ron Goldfarb last year.

As the IEEE normally finalizes its budget in April, only an indicative figure of an additional ~ \$100k has been provided to the Finance Committee Chair, Mark Kief. This addition is based on the virtual inclusion of the MMM Reserve Fund portion for the Society to the Society's Reserve. Please submit any new initiative proposals to the Secretary-Treasurer, Sara Majetich.

Another good news is that Magnetics Letters is again recognized as a "high performer" by the IEEE



based on the fact that the average number of weeks from submission to first decision and to online post in the fourth quarter of 2022 were 3.8 and 8.3, respectively. The averages for the entire year were 3.2 and 7.5, respectively. I would like to congratulate the Editorial Review Board, namely the chief editor, Massimiliano d'Aquino, and his team, and I encourage you to submit your works to be published quickly.

Click icon to directly go to the article in this newsletter

I would also like to update our Magnetism in Ukraine program led by Sara Majetich and Andrii Chumak.

The Education and Technical Committees worked with the Science and Technology Center in Ukraine (STCU) to authorize \$180k last year. Olena Taberko (STCU), Oleksandr Tovstolytkin (Institute of Magnetism)

and Andrii reported that this program offered individual grants of \$2,000 and group grants of \$10,000 for the period of one year. The STCU has received 70 applications and selected 22 projects based on the reviews conducted by a team of 23 researchers, including the representatives of the Technical Committee. In total, 70 researchers received financial support, including 14 females and 14 students.

As of March 2023,

3
peer-reviewed publications have been published and

over **10**
more are in preparation.

↑64
new members joined the Society.

A full report will be submitted by the end of this year by the Education Committee, chaired by Hyunsoo Yang.

The Magnetics Society's financial support for magnetics researchers in Ukraine was based on their active involvement in the magnetics community and their personal circumstances. IEEE and the Magnetics Society are politically neutral.

In the last two months, the Committee Chairs have met online on the first Friday of every month.

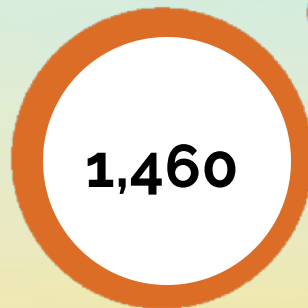
We discussed how we can make our Society and Conferences more attractive and beneficial for members informally. We plan to materialize some of the ideas in the coming months and propose some new initiatives at the May Administrative Committee (AdCom) meeting. We again welcome your comments and suggestions to successfully recover from the difficulties we faced in recent years.

We also organized an online induction to for AdCom voting members on the last Friday in March. This induction offered an overview of the Society's operations, including governance, structure, and budget. We had a lively discussion and will make the recording available for those who could not attend.

These online meetings can be regarded as a positive outcome of the COVID-19 pandemic. We get used to having such virtual meetings, which give facilitate speedy decision-making and frequent communication among ourselves. However, these meetings reduce the benefits of meeting in person to certain degrees, with additional consideration on carbon footprint and recent travel difficulties. For our conferences, we may need to find the right balance between virtual and in-person components. As we learned that the IEEE plans to continue a hybrid format for its conferences for the foreseeable future, the Conference Executive Committee continues to discuss the best balance for the Society.

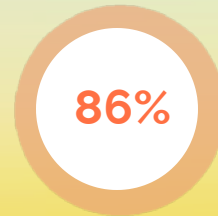
Thanks to the excellent work done by the InterMag 2023 (May 15-19, Sendai, Japan) team led by the Conference Co-Chairs, Beth Stadler and Koki Takanashi, and Secretary-General, Yoichiro Tanaka, I am very pleased to forward their recent statistics:

the coming InterMag attracted



presentations, including symposia and invited talks

of which about



in-person attendance is expected.

It is our hope that this will be a milestone in the Society's recovery from the above-mentioned difficulties. They have also planned to organize many new activities, such as local laboratory tours, help desks for early career researchers to study/work in Asia, a showcase of key achievements in our fields, and more. We look forward to seeing you in Sendai!

Please note that we will have satellite conferences before and after the InterMag:



International Network for Spintronics: Early Career Researchers Meeting
May 12-13,
Sendai, Japan



International Symposium on Integrated Magnetism
2023, May 14-15,
Sendai, Japan



Spin Caloritronics XII
May 22-25, Tsukuba,
Japan



24th International Conference on the Computation of Electromagnetic Fields
May 22-26, Kyoto, Japan

Click icon to directly go to conference calendar



I would also thank Andy Kent, Enrique del Barco and Olga Kazakova, who organized the Magnetic Frontiers Conference on Quantum Technology held on April 19-22 in Orlando, Florida, USA.



This is the third conference of Magnetic Frontiers, which is the premier topical conference on emerging aspects of fundamental and applied magnetism. The conference provides a unique environment for researchers to communicate and discuss the focused topic due to the relatively small number of participants (about 80 people). The Conference focused on recent developments in quantum phenomena in magnetism. Further details can be found in the following link: <https://physics.nyu.edu/magneticfrontiers2023/index.html>.

To continue our success story, a call for expressions of interest in the next Magnetic Frontiers Conference in 2025 has been broadcasted on our [website](#).



I am grateful to report that the following conferences have been approved for support by the Society. Please consider attending them.



- The European Conference Physics of Magnetism 2023 (PM'23) (26-30 June 2023, Poznań, Poland, Financially supported): <https://www.ifmpan.poznan.pl/pm23/index.html>
- Magnonics 2023 (30 July-3 August 2023, Paris, France, Technically sponsored): <https://magnonics2023.sciencesconf.org/>
- 25th International Conference on the Computation of Electromagnetic Fields (Compumag 2025) (9-12 June 2025, Naples, Italy, Technically sponsored): <http://www.compumag2023.com>

The oral history ad hoc committee led by Liesl Folks has been interviewing several researchers who have made significant contributions to the Society. This is part of the IEEE and Magnetics Society project to archive (video) recordings of interviews and the associated transcripts. Five interview videos as well as their 3-minute summaries have been uploaded to the Society's website and [ieee.tv](#). They feature behind-the-scenes stories of major discoveries and achievements, and more interviews are in progress. Please check them out.

Click image to directly go to the videos




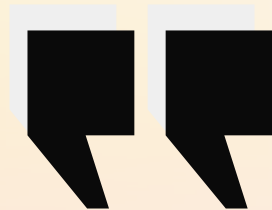
In the past months, the Society renewed our sister society agreements with the European Magnetism Association, the Spanish Club of Magnetism, and the Magnetics Society of Japan, and also signed a new memorandum of understanding with the Brazilian Materials Research Society (B-MRS). These will ensure our international collaborations and activities, especially since B-MRS will jointly organize Intermag 2024 in Rio de Janeiro, Brazil. We will feature their activities in our Newsletters.



This year, the IEEE plans to review our activities after its last review five years ago. As a first step, the President-Elect, Ron Goldfarb, has been collecting any comments you may have on the Constitution and Bylaws of the Society, which are due to be updated biennially. In addition, the Publications Committee attended a meeting in Chicago in April, where the IEEE Periodicals Review and Advisory Committee (PRAC) reviewed our publications. I'd like to warn you ahead of time that I'll be getting in touch with the committee chairs for the five-year review in the early summer.

Please visit our [Society's website](#) to learn more about our accomplishments, where you will find the latest contact details of the officers, committee chairs, and AdCom members. It also includes a list of chapters, sister societies, new volunteer signup forms, and more.

In closing, I would also love to hear any comments and/or suggestions from the members by e-mail and at conferences. Your thoughts and feedback are more than valuable for the future of the IEEE Magnetics Society. 



Atsufumi Hirohata

President of IEEE Magnetics Society

Email: atsufumi.hirohata@york.ac.uk



IEEE Magnetics Letters

Confirmed Recognition for Short Submission- to-Publication Times

by **Massimiliano d'Aquino**
Chief Editor, *IEEE Magnetics Letters*



I am absolutely thrilled to announce that IEEE Magnetics Letters (IML) has once again been designated as a high performer by the IEEE Technical Activities Board's Periodicals Committee, this time for the fourth quarter of 2022 and also for the 2022 full year.

This achievement follows earlier accolades for the first and third quarters of 2022. Receiving this honor three times in a single year is remarkable. Our journal has been ranked in the first quartile for short times for both submission-to-first-decision and submission-to-publication in the fourth quarter of 2022 (in 2022 full year), with an average of just 3.8 (3.2) weeks and 8.3 (7.5) weeks, respectively.

As Chief Editor, I could not be prouder of our team's outstanding achievements. Maintaining excellence in such a competitive landscape is a tremendous feat, and our dedicated Editorial Review Board,


journal production manager, and editorial assistant have once again proven their unwavering commitment to upholding the highest standards of quality.


I would like to express my deepest gratitude to all of our team members for their tireless work and dedication, as well as to all those who contribute to the Magnetics Society's mission of promoting excellence in publications.

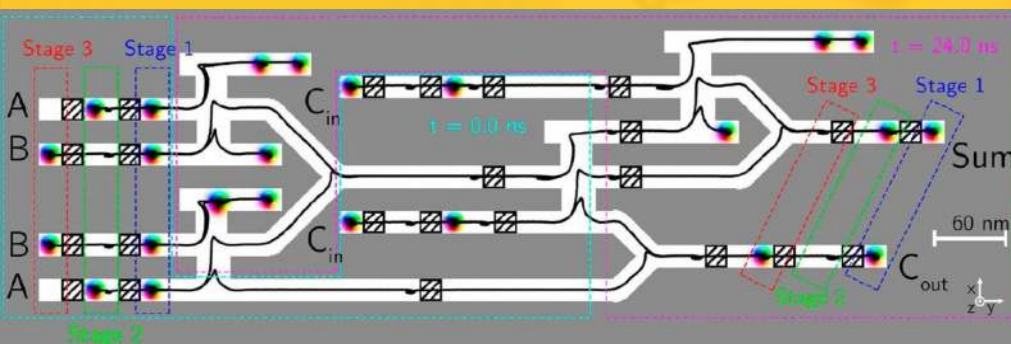
Since its establishment in 2010, IML has been committed to publishing scholarly articles of substantial current interest covering the physics and engineering of magnetism, magnetic materials, applied magnetism, design and application of magnetic devices, bio-magnetics, magneto-electronics, and spin electronics. With this latest recognition, we are more motivated than ever to continue our efforts to provide thoroughly peer-reviewed and fast publication of cutting-edge research performed within the magnetics community.



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information on the
IML webpage 

Articles can be
submitted through
this link 



In Memory of

Al Hoagland

passionate for computer storage
technology and great contributor
to the disk drive industry

by John Best, Roger Wood
and Thomas Coughlin

Albert S. Hoagland passed away on October 1st, 2022, at the age of 96 in Portland, Oregon. His intellectual contributions and passion for computer storage technology contributed greatly to the disk drive industry, from its very beginning with the IBM RAMAC in the 1950s through to preserving its history.

Al grew up in Berkeley, California and attended UC Berkeley for B.S., M.S., and Ph.D. degrees in Electrical Engineering, completing his Ph.D. in 1954.

While still a graduate student at UC Berkeley, Al began consulting with IBM on the magnetic design for the RAMAC, the first disk drive product and forerunner of all disk drives to the present day.

He went on to join IBM's Research Laboratory in San Jose in 1956 and helped guide the magnetic scaling required for higher-density disk drive designs to follow the RAMAC. Still in the 1950s, he did early theoretical and experimental work on perpendicular recording, preparing for its potential use in products subsequent to the RAMAC. Difficulty developing a satisfactory perpendicular recording medium and successful scaling of longitudinal recording resulted in shelving perpendicular recording in those early days.





Photo courtesy of Santa Clara University

Perpendicular recording was finally realized in disk drive products in late 2005 / early 2006, when scaling of longitudinal recording was no longer viable.

Al wrote the first book dedicated to magnetic recording for data storage, “Digital Magnetic Recording,” in 1963.

He and James Monson collaborated to write an updated version of the book in 1991. The book contains a particularly elegant derivation and discussion of reciprocity between read and write heads, used to calculate read response.

Based on his early and continuing belief in the value of computing technology, Al was very active in establishing and promoting industrial and academic societies and collaborations.


He was a fellow of the IEEE, a past president of the IEEE Computer Society and the American Federation of Information Processing Societies, served on the IEEE Board and Magnetic Recording Conference (TMRC) Advisory Board and was a trustee of the Charles Babbage Foundation.

Al helped establish the university centers for magnetic recording and data storage at University of California, San Diego (UCSD), and Carnegie-Mellon University (CMU) and served as the first director of the Center for Memory and Recording Research (CMRR) at UCSD. After retiring from IBM in 1984, Al joined Santa Clara University and established the Institute for Information Storage and Technology, educating many students from both the university and industry on a wide variety of storage topics, and sponsoring an annual conference of industry technical leaders at Lake Arrowhead.

Al had a great passion for preserving the history of computers, in particular the early development of disk drive storage. He combined this with his dedication to education when he arranged for IBM to loan a RAMAC disk drive component to Santa Clara University. He assembled a team of students and retired IBM advisors to begin restoration of the RAMAC to working order. Following the initial phase of the restoration, he recruited additional experienced engineers and engaged with the Computer History Museum to provide a permanent home for restoration, display and demonstration of the RAMAC. He also established the Magnetic Disk Heritage Center to preserve the early history of disk storage and gained recognition for the historical origin of disk storage at 99 Notre Dame in San Jose.

Members of the team involved in the restoration and ongoing RAMAC demonstrations will be forever thankful to Al for providing this opportunity to participate in the living history of our industry and to see the enthusiastic reaction of museum visitors seeing the RAMAC in action.

He was persistent and gently forceful in arguing for technical and organization directions he was passionate about. Al was a pleasure to work for or with, and he always provided wise counsel to his colleagues.

Al was married to his wife, Janine, for 60 years and was always dedicated to his family. He moved to Portland, Oregon to be with family after retiring from Santa Clara University. He is survived by his three children and five grandchildren. 



In Memoriam of

Vitalij K. Pecharsky

a brilliant scientist, caring
mentor, and passionate
leader devoted to
understanding energy-
relevant materials

by Yaroslav Mudryk and Laura Millsaps
Ames Laboratory, USA

Vitalij K. Pecharsky, Ames National Laboratory Scientist and Anson Marston Distinguished Professor in Iowa State University's Department of Materials Science and Engineering, died on Tuesday, December 20, 2022, aged 68. A brilliant scientist, caring mentor, and passionate leader, he devoted his life to the discovery and fundamental understanding of energy-relevant materials. He was interested in and made a lasting contribution to a variety of topics: basics and application of x-ray powder diffraction; composition-structure-property relations in rare earth intermetallic compounds; experimental study, theory, and modeling of thermomagnetic phenomena; novel hard magnetic materials containing less-critical elements; and hydrogen-storage materials. Above all, however, he will be remembered as one of the founding fathers of room temperature magnetocaloric refrigeration.



Vitalij was born in 1954 in Lviv, Ukraine to a family of scientists, who instilled a love for learning, science, and discovery into him from an early age. Throughout his high school years he was interested in all things Physics and Chemistry. With the guidance of his teachers, he excelled in both of those subjects, becoming a winner of multiple regional and state level competitions. Following those early achievements, he pursued chemistry in his studies at Ivan Franko Lviv National University, Department of Chemistry. He graduated *summa cum laude* in 1976, and was invited to join the Ph.D. program, which he also successfully completed in 1979, specializing in Inorganic Chemistry.

After obtaining his Ph.D., Vitalij split his time between teaching and active research. He also liked coding, and together with a group of like-minded individuals in Lviv (also including L. Akselrud, Yu. Grin, and P.Y. Zavali), in 1980 they built a first of its kind, state-of-the-art, Crystal Structure Determination software, which they simply called CSD. The software can be used to obtain detailed structural information of crystalline compounds based on the x-ray and neutron powder and monocrystalline diffraction data. This early part of his career remained a pillar of his teaching and mentoring activities. When he became a professor at Iowa State University, Vitalij taught hundreds of students crystallography and x-ray diffraction during their undergraduate and graduate studies, influencing multiple generations of young scientists.

In 1989 Vitalij visited the United States for the first time as part of an exchange program organized by the International Research & Exchanges Board (IREX) in Princeton, NJ. That's where he met his mentor, Karl Gschneidner, Jr. who invited him to come to Iowa, where Vitalij became a scientist in the U.S. Department of Energy's Ames Laboratory in 1993. He earned the title of Associate Scientist in 1995, Senior Scientist in 2001, and Anson Marston Distinguished Professor of Engineering in 2007—the highest recognition of engineering faculty at Iowa State University. From 2010 to 2013, Pecharsky served as the Associate Chair for Research and Economic Development for the Department of Materials Science and Engineering.



In 1997, together with Gschneidner, Pecharsky discovered a significant magnetocaloric (cooling) effect in Gadolinium-Silicon-Germanium alloy, $Gd_5Si_2Ge_2$, which spurred a new global principal research area. Until this moment, magnetocaloric refrigeration was a 70-year-old technology suitable for cryogenic application at ultralow temperatures only. Now, it became possible to imagine solid-state caloric cooling as a viable, more energy-efficient, environmentally friendly alternative to the conventional vapor-compression technology. The discovery led to multiple patents, awards, and worldwide recognition. Vitalij's research was funded by multiple grants from the US Department of Energy, employing dozens of individuals as part of his group's research.

In 2016-2018, Vitalij served as the Director of CaloriCool, a consortium of research organizations dedicated to developing caloric cooling technologies.

It was his dream to see commercial refrigerators employing magnetic cooling principles in stores and supermarkets, and he worked long hours, tirelessly and passionately, often ignoring weekends and holidays, in pursuit of this dream.

The story goes that at a conference, a presenter told the audience that they will develop a commercial version of magnetic refrigerator that would cost 100 dollars only.


Vitalij opened his wallet without hesitation:



Here is your hundred dollars – when can I expect the delivery?”



Sadly, Vitalij will not get a chance to see this dream of his come true. But when it happens, he will be remembered for his intellectual contributions, leadership, and dedication to the future of solid state caloric technology.



At the same time, Vitalij did not have a "comfort zone," and was always eager to pursue any research direction he would find interesting. His interests span from basic science of rare earth metals to hydrogen storage potential of aluminum hydride. In all of these research areas he pushed for perfection. He was an author of more than 500 articles in refereed journals, held over 30 patents, and served as Editor in Chief of the Journal of Alloys and Compounds. For many years he also served as an editor for the Handbook on the Physics and Chemistry of Rare Earths - a prestigious series of book chapters encompassing all areas of groundbreaking research on rare earth compounds. He was an active member of rare earths, crystallographic, and magnetic refrigeration communities and helped to organize multiple scientific conferences and symposiums.

In his spare time he loved spending time with his loving wife, Olena. Together with Olena they traveled the world, gardened, cooked and enjoyed life. Some of his favorite hobbies included hunting, fishing, and trying different foods of the world. Vitalij is survived by two children and three grandchildren.



New Senior Members

The following members of the IEEE Magnetics Society were recently elevated to the grade of Senior Member:

**February
2023:**

Dragan Dinulovic
Amal El-Ghazaly
Jose Miguel Garcia-Martin
Jeong-Heon Park
Debabrata Roy
Yukiko Takahashi

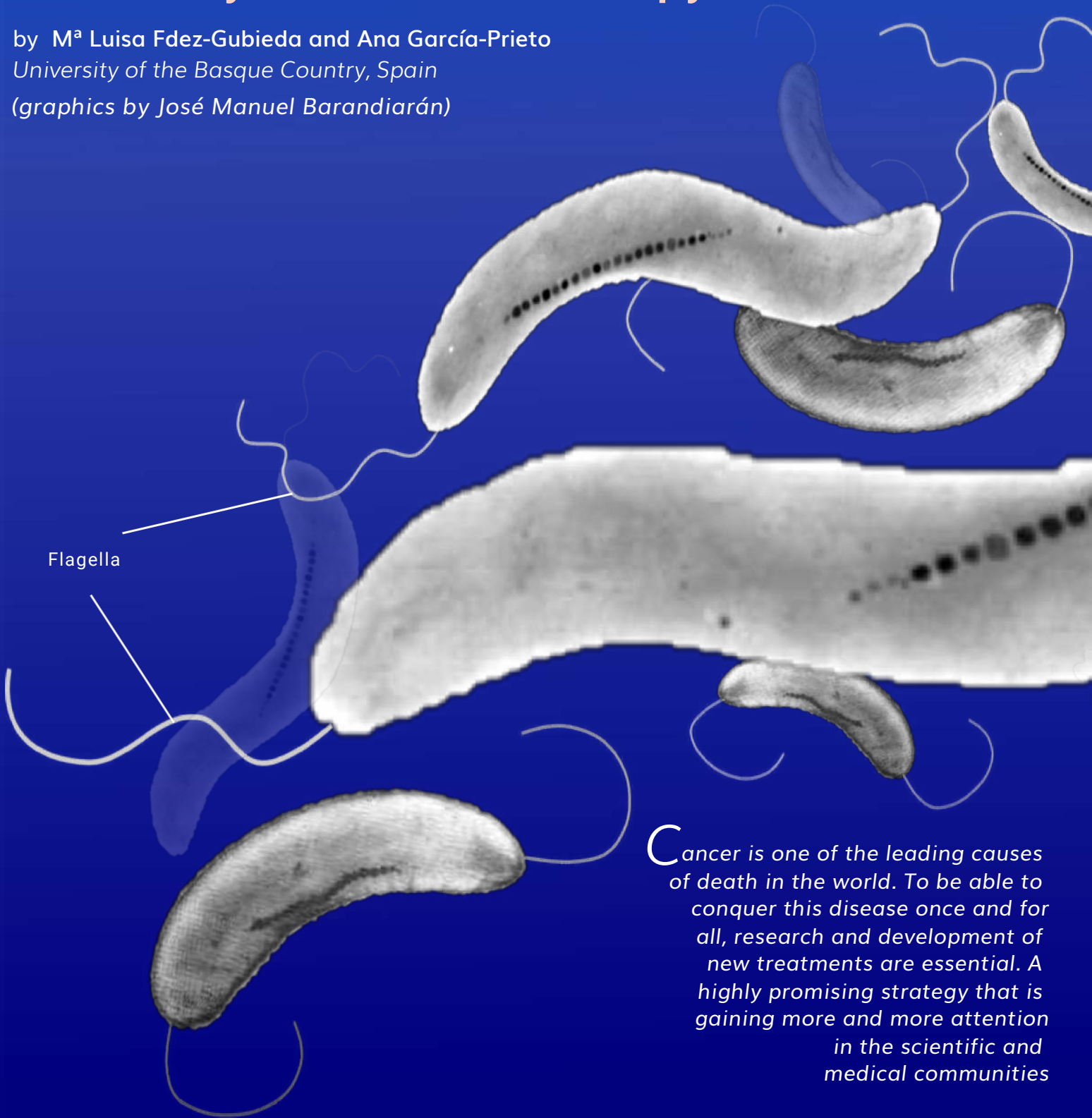


For more information on elevation to Senior Member, visit the IEEE Senior Member Grade Webpage.

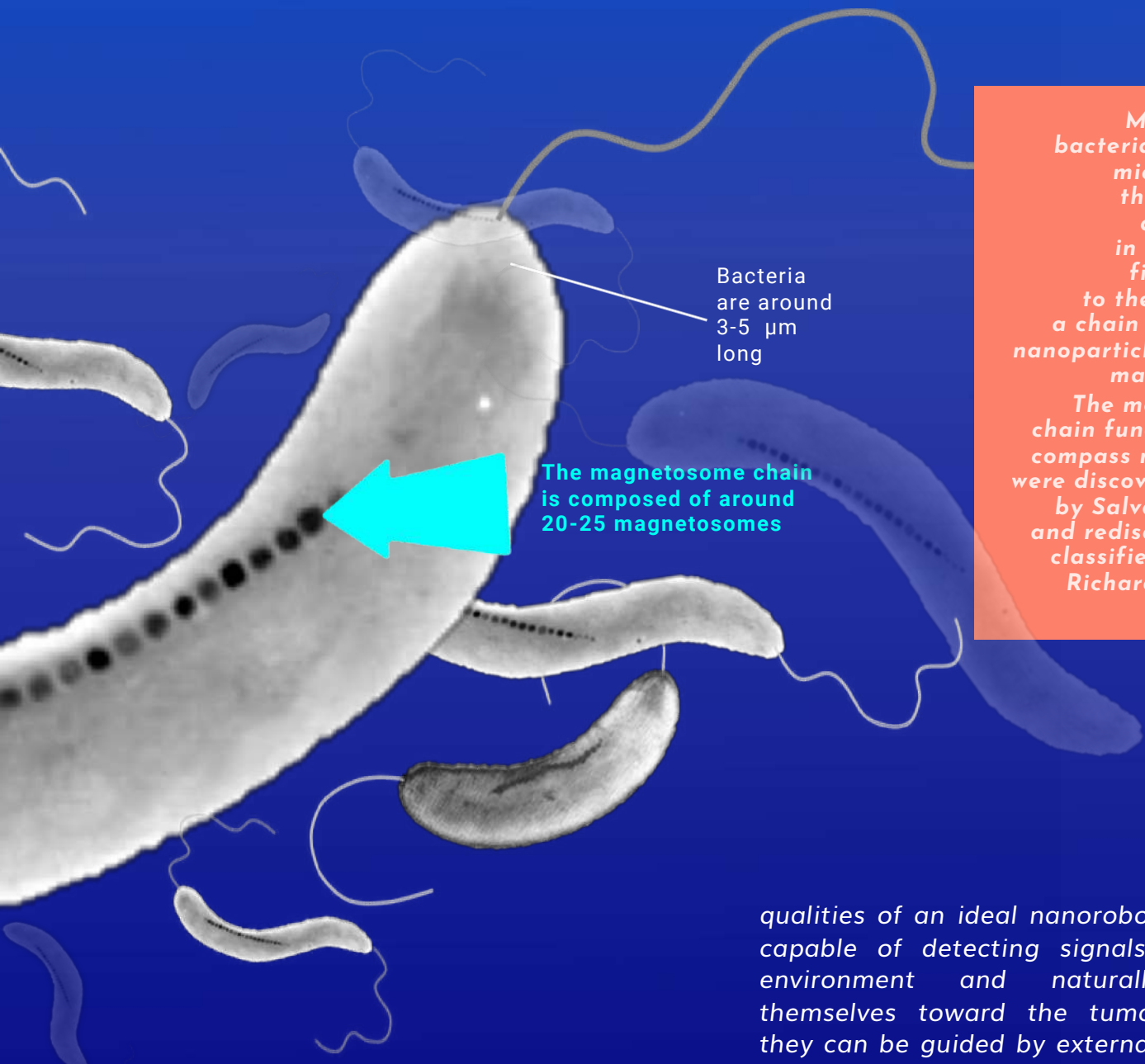
Magnetotactic Bacteria:

Biological Nanorobots and Their Suitability for Cancer Therapy

by M^a Luisa Fdez-Gubieda and Ana García-Prieto
University of the Basque Country, Spain
(graphics by José Manuel Barandiarán)



Cancer is one of the leading causes of death in the world. To be able to conquer this disease once and for all, research and development of new treatments are essential. A highly promising strategy that is gaining more and more attention in the scientific and medical communities



Bacteria are around 3-5 μm long

The magnetosome chain is composed of around 20-25 magnetosomes

Magnetotactic bacteria are aquatic microorganisms that can orient and navigate in geomagnetic field lines due to the presence of a chain of magnetic nanoparticles known as magnetosomes. The magnetosome chain functions like a compass needle. They were discovered in 1963 by Salvatore Bellini and rediscovered and classified in 1975 by Richard Blakemore.

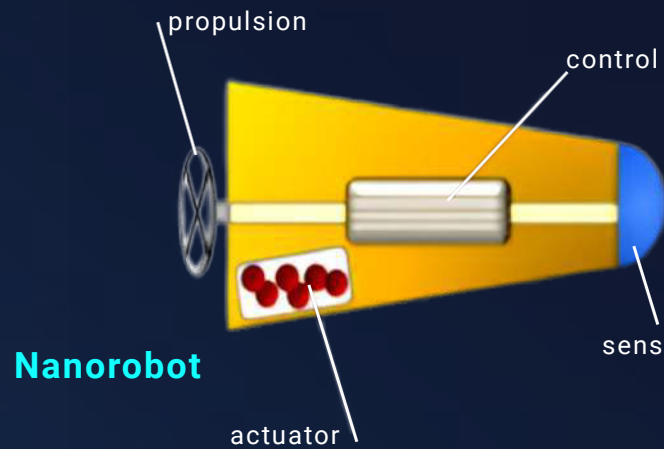
is the use of multifunctional nanorobots that are capable of delivering drugs only to the affected area while also simultaneously attacking tumor cells through magnetic hyperthermia treatments. In this article, we introduce a very unique class of nanorobots for cancer treatment: the magnetotactic bacteria. These microorganisms seem to have been created specifically to carry out this task because they naturally have all the

qualities of an ideal nanorobot: they are capable of detecting signals from the environment and naturally propel themselves toward the tumor regions; they can be guided by external magnetic fields to the desired location; and they are easy to be detected. As if that were not enough, it is also possible to functionalize these bacteria to transport drugs to the tumor site, minimizing the side effects associated with the systemic administration of certain drugs routinely used to treat cancer. These bacteria can even be heated up by using alternating magnetic fields, weakening or ultimately killing the cancer cells.

According to data from the World Health Organization [1], cancer is the second most common cause of death in the world, with a mortality rate greater than 50%. Its magnitude is such that if alternative strategies are not considered, it is expected that the diagnosis of new annual cases in the world will go from the current level of 19 million to more than 25 million in 2035 [1]. The usual treatments to combat this disease are based on a combination of surgery, with which the bulk of the tumor is removed, and radiotherapy and chemotherapy, which attack the cancer cells that persist from the tumor tissue. These therapies carry side effects that often harm the lives of patients [2]. Thus, there is a need to explore new routes for the fight against cancer, which in many cases involve the use of nanotechnology.

The use of nanorobots in medicine has attracted the attention of the scientific community, and more and more researchers are focusing their research on this field. The open question is, what characteristics should a nanorobot have to be the perfect agent for cancer therapies?

In general, a nanorobot must be capable of self-propelling, reacting to stimuli, being detectable, producing and/or transporting drugs, and locating tumors [3]. In order to meet these needs, in recent years, different types of nanorobots have been proposed, for example, magnetic nanoparticles (MNPs) [4] and biological entities, such as viruses and bacteria [5, 6].



Magnetotactic bacteria as biological nanorobots

The presence of the magnetosome chain allows magnetotactic bacteria to be guided, tracked, and heated by external magnetic fields. These capacities, together with the self-propulsion capability provided by their flagella and their natural attraction to hypoxic areas, such as tumor regions, envisage magnetotactic bacteria as promising biological nanorobots to home-in on tumors, deliver drugs, or heat up cancer cells.

MNPs are generally composed of an iron oxide core with a diameter ranging from 5 to 50 nm, surrounded by a biocompatible layer. Their ability to locally heat the tumor, known as magnetic hyperthermia, is one of the key features of using them for cancer therapy. During magnetic hyperthermia therapy, MNPs are injected into the tumor and subjected to an alternating magnetic field (AMF). Under the AMF, the MNPs describe a hysteresis loop, whose area is proportional to the dissipated energy, producing an increase in the temperature in the tumor. A local increase in temperature, around 4–7 °C, drives cancer cells to apoptosis without harming healthy cells.

[1] <https://www.who.int>

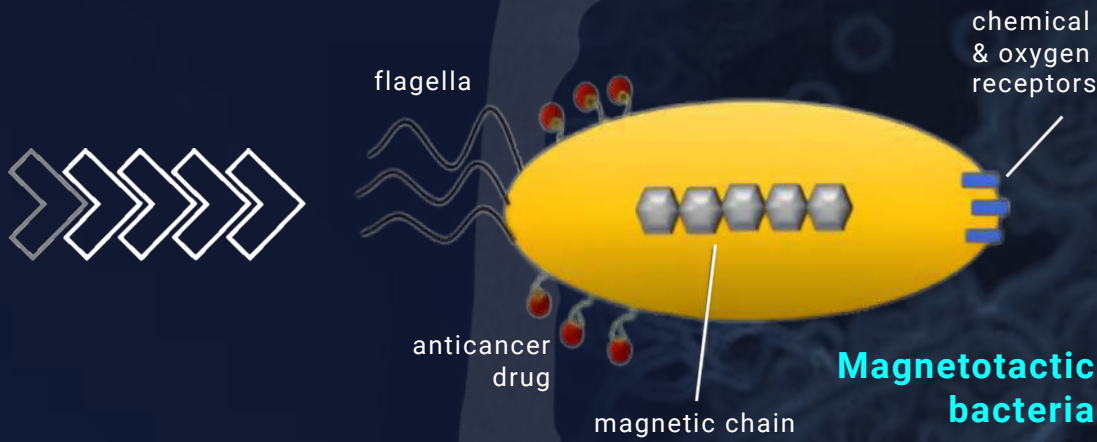
[2] Y. Chen, P. Jungsuwadee, M. Vore, et al. *Mol. Interv.* 7(3), 147–156 (2007).

[3] A.C.H. Tsang, E. Demir, Y. Ding, et al. *Adv. Intell. Syst.* 2(8), 1900137 (2020).

[4] C. Blanco-Andujar, F. J. Teran, D. Ortega, Chapter 8 in *Iron Oxide Nanoparticles for Biomedical Applications* (Elsevier), p. 197 (2018).

[5] S. Zhou, C. Gravekamp, D. Bermudes, et al. *Nat. Rev. Cancer* 18, 727–743 (2018).

[6] B.-Q. Park, J. Zhuang, O. Yasa, et al. *ACS Nano*, 11(9), 8910–8923 (2017).



The use of MNPs as hyperthermia agents in cancer therapy has been approved since 2011 by the EMA (European Medicines Agency) for the treatment of brain tumors and in 2014 by the FDA (US Food and Drug Administration) for the treatment of glioblastoma and prostate cancer. Currently, patients with prostate and pancreatic cancer are participating in clinical trials [7].

Unfortunately, there are some drawbacks to using nanoparticles, such as the absence of self-propulsion. Utilizing biological entities, such as bacteria, is an alternative trend that is gaining ground. The effectiveness of bacterial therapy against cancer relies on several characteristics.

One is motility as bacteria can actively swim by using their flagella to penetrate deeper into the tumor tissue. Due to the irregular and chaotic vasculature, tumors have low oxygen concentrations. Such hypoxic regions are ideal for anaerobic/microaerophilic bacteria to perform selective colonization. Second, bacteria perform direct oncolysis by secreting exotoxins in the tumor area and competing for nutrients. Finally, bacterial infections cause the immune system to become active, which attacks not only bacteria but also tumor cells [5]. In recent years, the FDA [8] has approved clinical trials using various bacterial species that have shown promising results in eliminating tumors. Furthermore, there is currently a recognized medical procedure for treating bladder cancer that relies on the *Bacillus Calmette-Guerin* (BCG) species [9]. However, one of the main limitations, in this case, is the challenge of directing and/or detecting the bacteria once they have entered the human body.

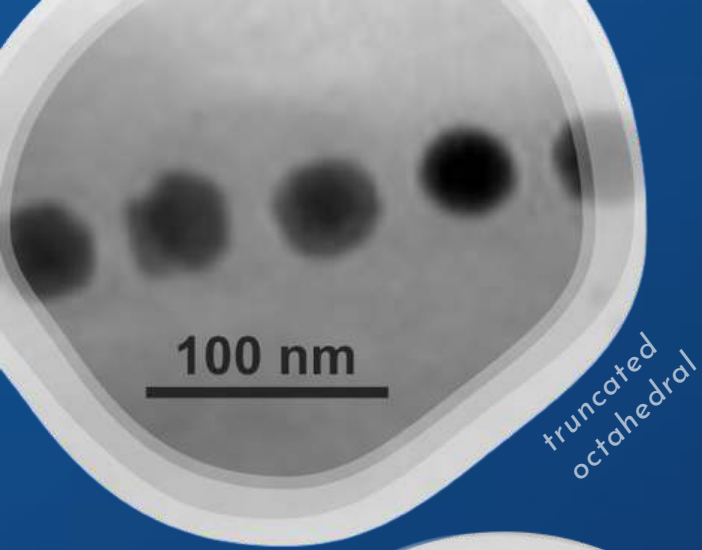
In this sense, there is a group of bacteria that has merged the advantages of MNPs and bacterial therapy: the magnetotactic bacteria [10].

[7] <https://magforcestudy.com/>,
<http://www.nocanther-project.eu/index.php>

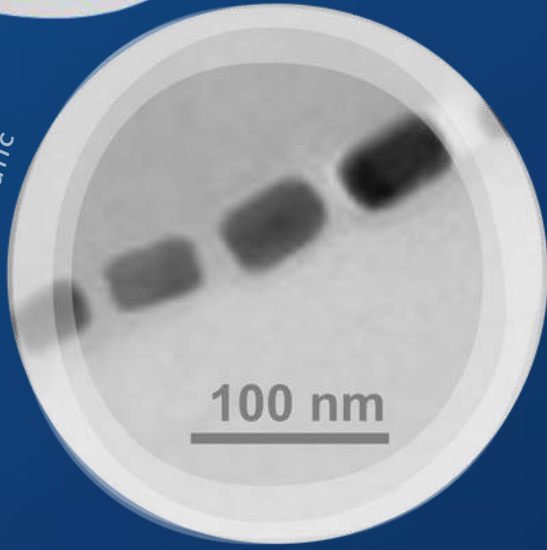
[8] <https://clinicaltrials.gov>

[9] A.M Kamat, T.W. Flaig, H.B. Grossman, et al. *Nat. Rev. Urol.* 12(4), 225 (2015).

[10] M.L. Fdez-Gubieda, J. Alonso, A. García-Prieto, et al. *J. Appl. Phys.* 128(7), 070902 (2020).



truncated octahedral



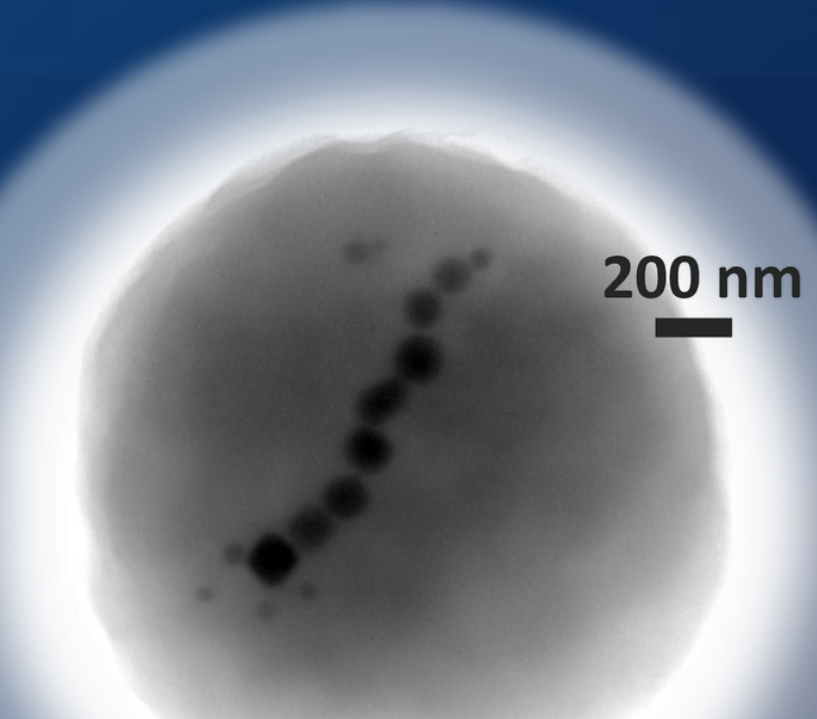
elongated prismatic

Magnetosomes

Magnetosomes consist of a core of a magnetic crystal surrounded by a lipid bilayer membrane. The size of the magnetic core ranges between 30 and 120 nm and the shape can be, among others, truncated octahedral, elongated prismatic, or bullet-shaped.

Magnetotactic bacteria (MTB) are a highly diverse group of motile aquatic organisms capable of biosynthesizing magnetic nanoparticles, called magnetosomes [11-13]. Magnetosomes consist of a mineral magnetic core surrounded by an organic envelope made up of a proteinaceous lipid bilayer membrane. The composition, morphology, and size of the magnetosomes are characteristic of each bacterial species. Most of them synthesize high-purity magnetite, Fe_3O_4 , although some produce greigite, Fe_3S_4 .

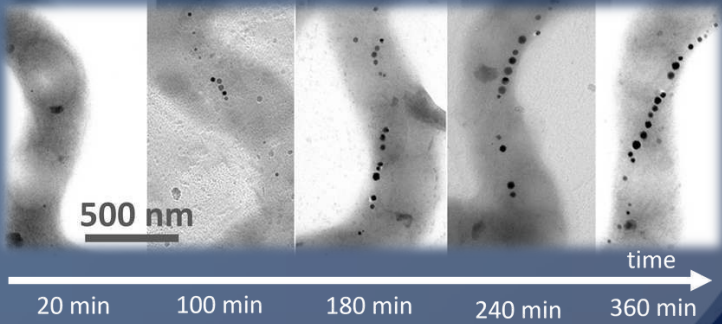
Magnetosome morphology can be truncated octahedral, elongated prismatic, and bullet- or tooth-shaped and the size ranges from 35 to 120 nm. In this range of diameters and morphologies, the magnetosomes are single magnetic domains that are stable at room temperature. Bacteria arrange magnetosomes into chains, which results in the magnetic moments of each individual magnetosome to add up, transforming the cell into a single magnetic dipole, with a magnetic moment of the order of $7.7 \cdot 10^{-16} A m^2$ [14].



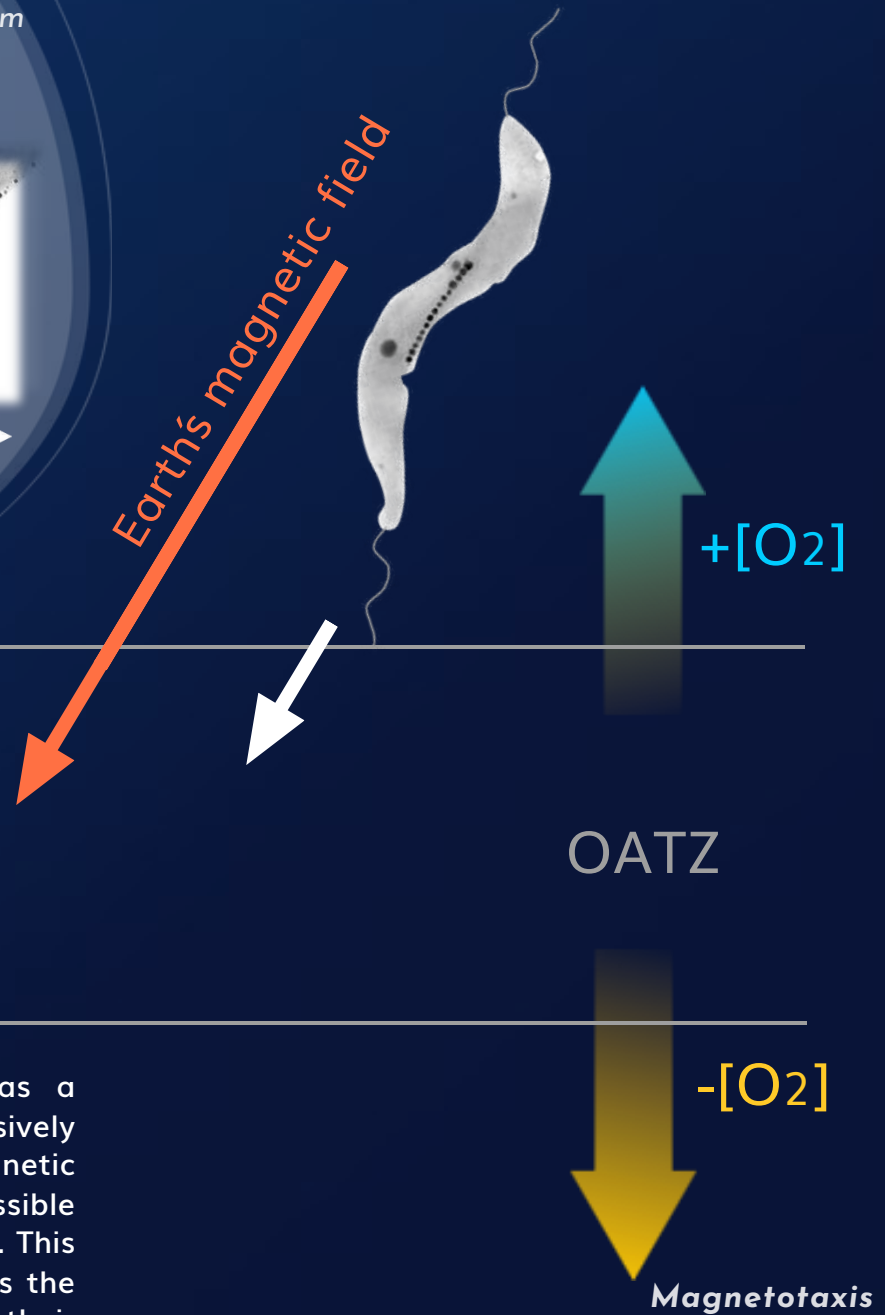
Magnetococcus marinus MC-1

Biomineralization

Through a biomineralization process, the bacterium synthesizes, under strict genetic control, magnetic nanoparticles, mainly magnetite, Fe_3O_4 , and in some cases, greigite, Fe_3S_4 . The composition,



size, and morphology of these nanoparticles, called magnetosomes, are specific to each bacterial species.



As a consequence, the chain acts as a compass that enables bacteria to passively orient themselves in the Earth's magnetic field while they actively swim, made possible by the presence of one or more flagella. This behavior, known as magnetotaxis, helps the bacteria search for nutrients in their preferred oxic-anoxic transition zone [9-11]. Additionally, MTB are micro/anaerobic organisms with oxygen sensors that enable them to navigate to areas with low oxygen concentration.

Magnetotaxis
The magnetosome chain serves as a compass that allows bacteria to passively orient themselves in the Earth's magnetic field while they actively swim, thanks to the presence of one or more flagella. This behavior is known as magnetotaxis and helps bacteria to search for nutrients in their preferred oxic-anoxic transition zone (OATZ). Additionally, magnetotactic bacteria are micro/anaerobic organisms with oxygen sensors that allow them to navigate to regions with low oxygen concentration.

[11] R. Blakemore. *Sci.* 190(4212), 377–379 (1975).

[12] D.A. Bazylinski, R.B. Frankel. *Nat. Rev. Microbiol.* 2(3), 217-30 (2004).

[13] D. Faivre, D. Schüler. *Chem. Rev.* 108, 11, 4875–4898 (2018).

[14] C. Zahn, S., Keller, M., Toro-Nahuelpan, et al. *Sci Rep* 7, 3558 (2017).

Magnetotactic bacteria have been identified as ideal magnetic hyperthermia agents [15]. The heating efficiency of MTB arises from the presence of the magnetosome chain, and it is measured by a magnitude defined as the Specific Absorption Rate, SAR, which can be determined by the area of the AC hysteresis loops that the MTB describe under the application of an alternating magnetic field, given by the following expression:

$$SAR = \frac{f}{c} \oint \mu_0 M dH.$$

SAR depends on external parameters, such as the concentration of magnetosomes, c , and the amplitude, H , and frequency, f , of the applied magnetic field.

These parameters are limited by medical factors: the dose of magnetosomes, c , should be as small as possible, and the product of the amplitude by the frequency of the field should be below a safety limit,

$$H \times f \leq 5 \times 10^9 \text{ Am}^{-1} \text{ s}^{-1} \text{ [16].}$$

Since the SAR is proportional to the area of the AC loops, it also depends on intrinsic parameters of the magnetosomes, such as saturation magnetization, M_s , and magnetic anisotropy, K , which will define the magnetic response of the bacteria and the area of the hysteresis loop. One advantage of using bacteria over isolated magnetosomes is that bacteria have magnetosomes arranged in a chain along the longitudinal axis, resulting in an almost perfectly square hysteresis loop — the ideal magnetic response for maximum SAR values.

It is also possible to improve the SAR response by tuning the composition, size and morphology of the magnetosomes. In terms of composition, most bacteria synthesize magnetite, but by simply adjusting the composition of the culture medium, magnetite can be doped with different elements. For example, it has been found that adding transition metals or rare earth elements to the medium causes bacteria to incorporate up to 3-5 atomic percent of the element into the magnetite structure, modifying the magnetic response [17-19]. On the other hand, the morphology and size of magnetosomes are specific to each bacterial species, so by selecting a particular species, we can tune the magnetic shape anisotropy and as a result, the SAR response.

MTB are microorganisms difficult to grow in the lab and only a few species are currently kept in laboratories. In particular, *Magnetospirillum gryphiswaldense*, MSR-1, and *Magnetospirillum magneticum*, AMB-1, are strains that are easy to culture and most of the laboratories are working with them. Both strains synthesize truncated octahedral magnetite with a mean size of ≈ 40 nm. In both cases, the morphology of the magnetosomes is slightly distorted, which gives rise to an effective uniaxial anisotropy [6]. The main difference between both species arises from the arrangement of the magnetosomes in the chain: while MSR-1 presents a continuous chain, AMB-1 exhibits a fragmented one. The SAR responses of both species have been measured as a function of the amplitude and frequency of the applied magnetic field. Due to the chain arrangement of magnetosomes, the saturation value of the SAR normalized by the frequency, SAR/ f , is significantly higher in both cases than that of isolated magnetosomes ($\approx 5 \text{ Wg}^{-1} \text{ kHz}^{-1}$ [21]), reaching values as high as $\approx 8 \text{ Wg}^{-1} \text{ kHz}^{-1}$ for MSR-1 [15] and $\approx 12 \text{ Wg}^{-1} \text{ kHz}^{-1}$ for AMB-1 [20].

[15] D. Gándia, L. Gandarias, I. Rodrigo, J. Robles-García, et al. *Small*, 15(41) 1902626, 2019.

[16] R. Hergt and S. Dutz, *J. Magn. Magn. Mater.* 311, 187 (2007)

[17] L. Marcano, D. Muñoz, R. Martín-Rodríguez, et al. *J. Phys. Chem. C*, 122, 7541-7550 (2018).

[18] L. Marcano, I. Orue, A. García-Prieto, et al., *J. Phys. Chem. C* 124 (41), 22827-22838 (2020)

[19] E.M. Jefremovas, L., Gandarias, L., Marcano, et al. *Nanoscale Adv.* 4(12), 2649–2659 (2022).

[20] D. Gándia, L. Marcano, L. Gandarias, et al. *ACS Appl. Mater. Interfaces* 15, 1, 566–577 (2023).

[21] A. Muela, D. Muñoz, R. Martín-Rodríguez, et al. *J. Phys. Chem. C*, 120, 24437 (2016).

[22] T. Gwisai, N. Mirkhani, M.G. Christiansen, et al. *Sci. Robot.* 7, eabo0665 (2022).

Finally, MTB are promising drug delivery carriers. Magnetotactic bacteria have the advantage of being self-propelled and capable of interacting with biological systems, with preferential colonization in the tumor hypoxic area. MTB can be designed to specifically target and grow within tumors, and to be functionalized with therapeutic compounds that can destroy cancer cells. In addition, thanks to the magnetosome chain, MTB can be guided and tracked remotely with external magnetic fields, which could be directional, rotating and/or magnetic field gradients [22].

Future Trends

In order to apply magnetotactic bacteria to cancer therapies, several challenges must be overcome. First, there is a need to scale up MTB production and explore synthesis routes to control the magnetic behavior of MTB by manipulating the biomineralization process of the magnetosomes. Second, while MTB's ability to propel themselves through their flagella and the possibility to control their movement externally is a significant advantage, it is crucial to evaluate their ability to travel along the bloodstream and their penetration and distribution within tumors. Finally, research should focus on the potential of combining MTB with other treatments like photothermia and diagnostic techniques, such as Magnetic Resonance Imaging or Magnetic Particle Imaging.

Acknowledgments

This work is funded by the Spanish MCIN/AEI/10.13039/501100011033 (PID2020-115704RB-C31 project) and the Basque Government (project n. IT1479-22).



Maria Luisa Fdez-Gubieda is Full Professor of Applied Physics and principal investigator of the Magnetism and Magnetic Materials group at the University of the Basque Country (UPV/EHU), in Spain.

Throughout her career, she has studied the correlation between the structure and the magnetic properties of different materials, from metallic glasses to nanostructures, being one of her main activities the use of Large-Scale Facilities, especially synchrotron radiation techniques.

She is currently leading a multidisciplinary research project with the aim of studying the use of magnetotactic bacteria as a nanorobot for therapies against cancer. She combines her research activity with undergraduate teaching at the Faculty of Science and Technology of the UPV/EHU.

Ana García-Prieto received her Ph.D. in Physics from the University of the Basque Country (UPV/EHU), in Spain, in 2003. Her field of expertise focuses on magnetic nanostructures, both the analysis of their fundamental magnetic and structural properties, mainly with synchrotron radiation techniques, and their biomedical applications. Currently, she works in the Group of Magnetism and Magnetic Materials at the UPV/EHU studying magnetic nanostructures biosynthesized by magnetotactic bacteria. She combines her research activity with undergraduate teaching as an associate lecturer at the School of Engineering of the UPV/EHU.

Jose Manuel Barandiaran is Professor Emeritus of Applied Physics at the Universidad del País Vasco (UPV/EHU), Bilbao (Spain), where he served as Full Professor and member of the Group of Magnetism and Magnetic Materials since 1988. He is mainly interested in Magnetism and Magnetic Materials and nuclear techniques, like neutrons and Mössbauer effect, for solid-state studies. He has visited several Universities in France, UK, USA, Denmark, and Japan. He was a co-founder and first President of the Spanish Club of Magnetism, participated in The European Magnetic Sensors & Actuators (EMSA) and The Soft Magnetic Materials (SMM) Int. Committees, as well as in other Scientific Societies and Institutions.

Magnetic Nanoparticles

for cardiovascular diseases

by Daniel Ortega and David Cabrera

University of Cadiz (Spain), Keele University (United Kingdom)

Cardiovascular diseases (CVDs) are one of the major killers in the Western World. In particular blood clotting disorders involving uncontrolled clot formation occluding blood vessels, or contrarily defects in the blood clotting system preventing coagulation, account for 1 in 4 deaths worldwide, lead to major disabilities, and entail a significant burden in most of the Western public health systems. A substantial part of these fatidic outcomes relies on the still immense room for improvement existent in techniques utilised for the diagnosis of blood clotting disorders. From the "humblest" electrocardiograms and echocardiograms to the more complex coronary angiography, computed tomography, and magnetic resonance imaging (MRI), many of the common shortcomings associated with these techniques are related to limitations in the field of view, the resolution/contrast, and the amount of useful information that can be extracted. Therefore, the scientific community has enthusiastically aimed at improving the deficient aspects of existing techniques during the last decades by using new approaches based on nanotechnology. One of the most popular trends has been magnetic nanoparticles (MNPs).

MRI underwent the greatest expansion following the use of MNPs during the 1990s, taking advantage of developments already made in the 1980s for tumour imaging at both the preclinical and clinical levels [1,2]. These findings have parallelly led to proposing the translation of this methodology into the field of diagnosis of CVDs. Through using MNPs, MRI could provide enhanced contrast and therefore more accurate diagnosis in clinical scenarios such as infarcted myocardium [3]. Hypothetically, this same enhancement of contrast could be utilised to perform more thorough inspections in the bloodstream [4]. Therefore, hidden occlusion of blood vessels or haemorrhages could be detected in a non-invasive manner in deep veins and arteries where other non-invasive methods, such as sonography, are ineffective.

Beyond the classical role of MNPs as a non-selective contrast agent, they have been proposed to label key components in blood coagulation, such as platelets, to make them visible under MRI.

Platelets are small fragments of cells that play a crucial role in the initial stages of blood coagulation. By activation and plugging in the site of puncture in the blood vessel, platelets pursue to prevent further blood loss in an equilibrium process called haemostasis.

[1] R. Weissleder, P.F. Hahn, D.D. Stark, et al. *Radiology*, 169 (2), 399-403 (1988).

[2] D.D. Stark, R. Weissleder, G. Elizondo, et al. *Radiology*, 168 (2), 297-301 (1988).

[3] W. Chen, D.P. Cormode, A. Fayad, et al. *WIREs Nanomed. Nanobiotechnol.*, 3 (2), 146-161 (2011).

[4] A.G. Próspero, C.C. Quini, A.F. Bakuzis, et al., *J Nanobiotechnology*, 15 (1), 22 (2017).



Traditionally, platelets have been labelled utilising radioactive tracers like ^{111}In or ^{51}Cr . While this approach has provided important insight into fields of research in cardiovascular disease and transfusion medicine, most European countries forbid the use of radioactive tracers for research in humans. By labelling platelets and other blood components involved in haemostasis with MNPs, selective tracking would provide a powerful tool to improve our understanding of the dynamics of blood coagulation in clotting disorders in humans.


Beyond their role as a contrast agent, MNPs could provide grounds to develop new diagnosis techniques in vivo for the detection of clotting disorders. Given the characteristic signals generated by MNPs circulating in the bloodstream, several studies have remarked on the potential of this technology to improve the detection of blood clot formation in blood vessels.

By using the mechano-magnetic relaxation properties of MNPs, proof-of-concept studies have displayed that MNPs could be a powerful tool for detecting blood clot formation in patients suffering from venous and arterial thrombosis [5-6]. This would enable us to create methods able to track blood clot formation in vivo in patients suffering from thrombosis in a minimally invasive and effective manner.

Complementing diagnostic techniques, MNPs-based therapeutic approaches are gaining traction to tackle cardiovascular diseases (CVDs). For instance, several groups have proposed the use of therapeutic modalities such as magnetic hyperthermia. Magnetic hyperthermia is a therapeutic modality using magnetic nanoparticles to generate highly localised heat when exposed to an alternating magnetic field. This emerging therapy has demonstrated to improve blood clot dissolving when used in combination with

[5] H. Khurshid, B. Friedman, B. Berwin, et al. *AIP Adv.*, 7 (5), 056723 (2017).





the enzymatic drug, tissue plasminogen activator (tPa) [7-8]. High doses of tPa currently utilised in clinics for severe conditions like stroke are associated with haemorrhagic episodes. The use of magnetic particle-based technology would enable to make enzymatic thrombolysis more effective and therefore potentially reduce their associated secondary effects.

The range of options continues to grow, and the field seems to evolve towards the combination of therapeutic and diagnostic techniques into single theranostic ones.

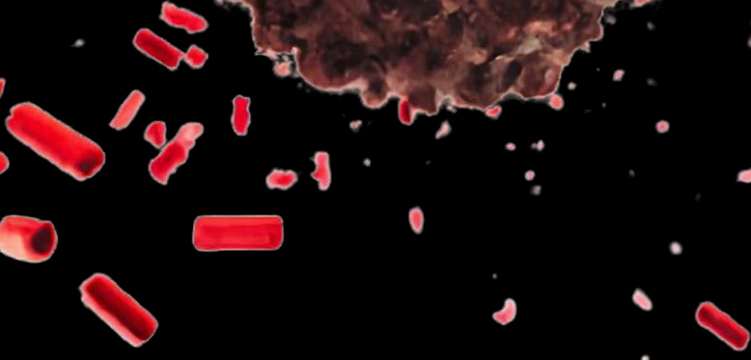
One of the most emblematic examples is the combination of magnetic hyperthermia with magnetic particle imaging (MPI). The latter is an emerging imaging technology that directly quantifies the concentration of injected MNPs into the body. The main advantage is that the signal is detected directly from the magnetic tracers, and thus linearly quantitative without tissue attenuation.

As it only images the MNPs, advanced MPI systems incorporate computed tomography (CT) scanners that allows the co-registration of X-ray images, which would involve the visualization of tissues and their superimposition with the MPI images of the location of the magnetic tracers. The key to achieving the multifunctionality here is that the underlying principles of MPI can be applied concomitantly to magnetic hyperthermia using the same device. The main advantage consists of providing localized heating of specifically targeted

[6] H. Khurshid, Y. Shi, B.L. Berwin, J.B. Weaver. *Med. Phys.*, 45 (7), 3258-3263 (2018).

[7] D. Cabrera, M.E. Sharifabad, J.A. Ranjbar, et al. *J. Thromb. Haemos.*, 20 (11), 2556-2570 (2022).

[8] E. Voros, M. Cho, M. Ramirez, et al. *Adv. Funct. Mater.* 25 (11), 1709-1718 (2015).



areas thanks to magnetic gradients that lock magnetic nanoparticles in the region of interest, with the possibility of using the heat for controlled drug release and/or as a therapeutic adjuvant in its own right. Besides, the MPI-hyperthermia binomial, new and more powerful combinations continue to emerge, and hybrid MRI-MPI systems have been already preclinically tested [9], with good prospects for transfer to clinical settings in the future. Although most of these technologies are still in the works, many of their most sought-after applications can already be glimpsed: local and reversible opening of the blood-brain barrier, in situ evaluation of therapies, bloodstream velocity reconstruction, real-time pharmacokinetics or targeting of nanobots.

Considering the recent progress made in the international regulatory framework for the use of nanomaterials in medicine,

the prospects around MNPs for CVD nanotheranostics are encouraging. However, the degree to which we are able to translate these developments into clinical practice will depend on our abilities to improve the overlap between the established non-clinical assessment, clinical trials, and marketing authorization protocols.



[9] J. Franke, N. Baxan, H. Lehr, et al. *IEEE Trans Med Imaging*, 39(12), 4335-4345 (2020).

Daniel Ortega

received his MSc and Ph.D. degrees in Condensed Matter Physics at University of Cadiz in 2003 and 2007, focused on the development of magneto-optic nanocomposites. In 2008, he joined the University of the Basque Country as a research associate working on anomalous magnetic properties of noble metal nanoparticles and diluted magnetic



semiconductors. In 2009, he won a postdoctoral Marie Curie fellowship to join the University College London (UCL) and the Royal Institution of Great Britain in London for three years. During this time, he specialised in the application of magnetic nanoparticles in biomedicine, particularly in hyperthermia for the treatment of certain cancers, as well as in tissue engineering and cell therapies based on mesenchymal stem cells. Daniel spent a short spell as a research associate at EIRIS institute, University of Toyohashi, in 2013. Later that year he joined IMDEA Nanoscience as an Assistant Research Professor through a Marie Curie Action, and became the leader of the Applied Nanomagnetism group. Starting from January 2020, he is Ramón y Cajal researcher at University of Cádiz. With deep research interests in nanomedicine, he was vice-chair of the COST action "RADIOMAG", the largest European network dedicated to the combination of magnetic hyperthermia and radiotherapy, and currently coordinates HIPERNANO, a Spanish national network on hyperthermia.



David Cabrera

graduated in Materials Engineering at University of Seville, Spain, in 2013. There he cultivated a special interest in magnetic materials and magnetic instrument development while working in Prof. Victorino Franco's group. Later, David moved to Madrid, Spain, to complete his Master's and Ph.D. studies in Condensed Matter

Physics, Nanoscience, and Biophysics at IMDEA Nanoscience, Spain. During this time, David started his transition from the field of material engineering to the multidisciplinary world of nanomedicine working in the group of Prof. Francisco Terán. There, he mainly focused on developing advanced tailored instrumentation for characterising exotic properties of magnetic nanoparticles for cancer treatment.

In 2018, David moved to Keele University, UK, as a Postdoctoral Research Associate joining Dr Alan Harper's group with the aim of developing a magnetic nanoparticle-based therapy to improve current stroke treatments. Recently, David was awarded a prestigious Sir Henry Wellcome Postdoctoral Fellowship. During the term of this fellowship, David will pursue to develop a novel magnetic nanoparticle-mediated therapy to provide a safer and more effective treatment for Venous Thromboembolism (VTE), a poorly treated disease with a high prevalence in the UK, which leads to up to 60,000 deaths a year in the country and many disabilities.

David's main interests and expertise relies on nanomagnetism, nanoparticles, and nanomedicine, and on how the special properties found in the nanoscale can be useful to effectively treat highly prevalent, lethal diseases such as cardiovascular disease and cancer.

Wohlfarth Lecture and Magnetism 2023 conference

by Liam O'Brien, Tom Thomson, Ivan Vera Marun,
Christoforos Moutafis & Kelly Morrison
IEEE UK & Ireland Magnetics Chapter

The Wohlfarth Lecture, co-sponsored by the IEEE UK & Ireland Magnetics Chapter and the Institute of Physics, took place at Magnetism 2023, which was held in Manchester, UK, on April 3rd and 4th 2023. The meeting also hosted the Annual General Meeting (AGM) of the Chapter.



Magnetism 2023 conference dinner at the Edwardian Manchester hotel.

The conference welcomed researchers from 15 different countries across Europe, USA and Asia. Returning to the University of Manchester, Magnetism 2023 saw over 160 attendees take part in the two-day event. The opportunity to meet face-to-face with colleagues was warmly received, with over 50 oral presentations, including 10 invited speakers and over 70 posters. The conference was co-chaired by Dr Christoforos Moutafis (University of Manchester, UK) and Prof Kelly Morrison (Loughborough University, UK), who noted: "The conference featured a diverse range of exceptional talks covering all major research areas of the UK Magnetism community. It was particularly gratifying to observe the enthusiastic response to the conference's focus on 2D Materials & Spintronics and Intelligent Computing. Overall, the vibrancy of the conference served as a testament to the strength and vitality of our community."

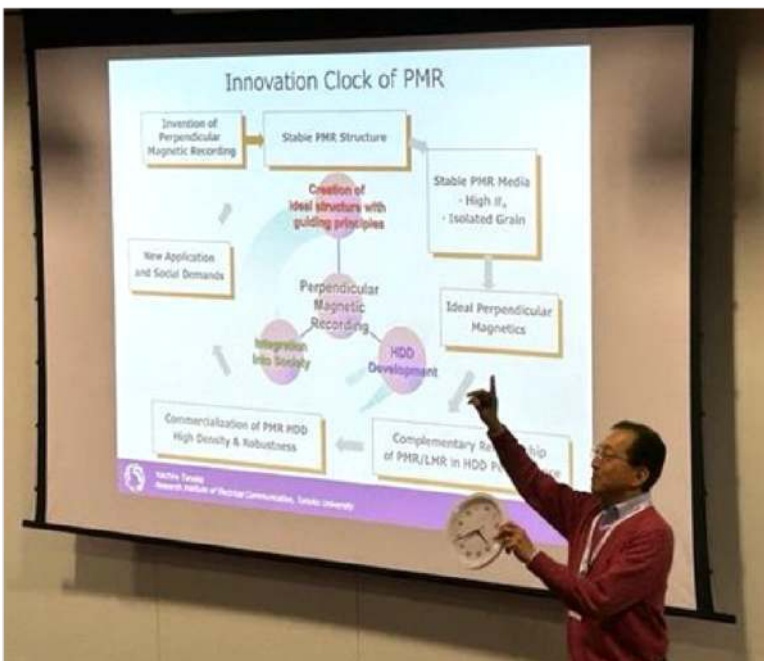
The conference scientific committee, led by Drs. Ivan Vera Marun (University of Manchester), Niladri Banerjee (Loughborough University) and Fasil Dejene (Loughborough University), developed an engaging and enjoyable programme, covering the breadth of magnetism research across the UK. A highlight of the first day of the conference was a plenary lecture given by Prof Pietro Gambardella (ETH Zurich, Switzerland) on current-induced magnetization switching of ferrimagnets and noncollinear antiferromagnets. Prof Gambardella gave an overview of his group's work on the study of magnetic and transport properties of thin film heterostructures and spintronic devices, including recent results on the asynchronous ultrafast switching of ferrimagnetic alloys and current-induced spin-orbit torque switching. The evening reception saw delegates attend a conference dinner in the 5-star Edwardian Manchester hotel; formerly the Manchester Free Trade Hall (for many years the home of the Hallé Orchestra) and Grade-II listed building originally constructed in 1856.



Magnetism 2023 attendees outside the Old Quad buildings at the University of Manchester

The conference also hosted three IEEE Magnetics Society Distinguished Lecturers. Prof Susana Cardoso De Freitas (INESC-MN, Portugal) discussed tailoring sensor performance in magnetoresistive devices; Prof Manuel Vázquez (Spanish Council for Research (CSIC), Spain), presented on the topic of cylindrical micro- and nanowires and their use in sensing applications; and Prof Yoichiro Tanaka (Research Institute of Electrical Conversion, Tohoku University, Japan) spoke on magnetic data storage technology and perpendicular magnetic recording using the metaphor of the 'clock of innovation' to project a timeframe for the next wave of spintronics technologies.

The second day opened with the award of the prestigious 2023 Wohlfarth Lecture. The Wohlfarth Lecture is an annual seminar given by a rising star across the worldwide magnetism community and is named in recognition of Peter Wohlfarth's contributions to the field of magnetism. It is co-sponsored by the IEEE UK & Ireland Magnetics Chapter and the UK & Ireland Institute of Physics Magnetism Group. This year's recipient, Dr Chiara Ciccarelli (University of Cambridge, UK), was recognised for the study of spin-charge conversion effects in inversion-asymmetric magnetic structures from slow to ultra-fast timescales, and is seen in the photo receiving the award from the IEEE UK and Ireland Magnetics Chapter chair, Dr Liam O'Brien. Dr Ciccarelli gave a fascinating insight into the role of picosecond spin Seebeck effects in spin-charge conversion using magnetic insulators as well as spin pumping using antiferromagnetic materials.



Prof Yoichiro Tanaka presenting his IEEE Distinguished Lecture, including the 'innovation clock' for perpendicular magnetic recording.

Dr Chiara Ciccarelli (left) receiving the 2023 Wohlfarth Lecturer prize certificate from IEEE UK & Ireland Magnetics Chapter chair, Dr Liam O'Brien (right).



The second day also saw an invited lecture by the Nobel Laureate Prof. Kostya Novoselov (Centre for Advanced 2D Materials, National University of Singapore). Prof. Novoselov presented work on 2D magnetic materials including transition metal dichalcogenides (TMD) as generators of spin orbit torque (SOT). An area which is gaining significant research traction, particularly for quantum applications, where the relatively low Curie/Néel temperatures found in many 2D magnetically ordered materials is not a serious impediment. He also noted that there are several materials in the 2D family with Curie temperatures close to room temperature.

The conference organising committee would like to thank the IEEE distinguished lecturers, the plenary speaker and the Wohlfarth lecturer, as well as all speakers for attending the conference and delivering highly stimulating presentations.

Qnami took the lead as the platinum sponsor of this year's conference, alongside a group of esteemed exhibitors including DCA Instruments, the UK Magnetics Society, Exeter Time-Resolved Magnetism (EXTREMAG), and Quantum Design. This included a sponsored student poster session prize, won by Dr Charles Swindells from the University of Sheffield (seen in the photo being congratulated by conference chair Dr Christoforos Moutafis) with runners up Prof. Nicola Morley (University of Sheffield) and Mr Guillermo Nava Antonio (University of Cambridge) also highly commended. Congratulations to all prize winners.



Dr Charles Swindells (left) receiving the 2023 poster prize award from conference co-chair Dr Christoforos Moutafis (right).

The next conference in the annual series, Magnetism 2024, will take place at the University of Loughborough, 24-25 March 2024 and will be chaired by Prof. Kelly Morrison.



MEET A MAGSOC ADCOM MEMBER

My Marcelo Knobel



My name is Marcelo Knobel, and I am currently the President of Insper¹, a higher education institution located in São Paulo, Brazil. From 2017 to 2021, I was the Rector of the University of Campinas (Unicamp) in Brazil, where I have also served as a faculty member for 28 years. Prior to becoming Rector, I had been the first Executive Director of the Unicamp Exploratory Science Museum and served as Vice-Rector for Undergraduate Programs. Apart from my leadership roles at Unicamp, I was also the Vice-President of the Brazilian Physics Society and Executive Director of the Brazilian Nanotechnology National Laboratory (LNNano) at the Brazilian Center for Research in Energy and Materials (CNPEM).

Currently, I am Editor-in-Chief of the Journal of Magnetism and Magnetic Materials, and I was Editor-in-Chief of *Ciência & Cultura*, a science and technology magazine published by the Brazilian Society for the Progress of Science (SBPC) for 10 years.

¹ See <https://www.insper.edu.br/en/> for further information

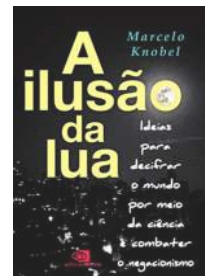
During my career as a physicist,

I created a competitive research group by obtaining grants to equip the laboratory, establishing international collaborations, and shaping the careers of many MSc and Ph.D. students. My field of research is magnetism and magnetic materials, mainly nanomagnetism and magnetotransport phenomena (giant magnetoresistance, giant magnetoimpedance). In our group, we fabricate novel nanostructured magnetic materials and fully characterize their structural and magnetic properties. I have published more than 300 articles in refereed journals in magnetism and magnetic materials (with more than 11,900 citations, h-index 53). Furthermore, I presented more than 80 invited seminars in several organizations, and more than 50 invited lectures at international conferences.

Although I have built a good reputation in my research area, I have always considered that I could have an even greater impact on society through science communication and outreach, which is of paramount importance for a developing country, such as Brazil.

Early in my career, I became active in science education and popularization. I was responsible for the creation of a Science Museum², and I was its first executive director (from 2006 to 2008). This activity shaped my leadership capabilities, including communication with the different stakeholders, such as the general public, science teachers, journalists, professionals acting on the project, suppliers, sponsors, other science centers and institutions, funding agencies and politicians. In 2019, I received the "José Reis Science Outreach Prize" from the Brazilian agency CNPq, which is considered the main award in this area, from my activities in this field.

During the COVID-19 pandemic, I launched a book to promote science in the fight against denialism and misinformation ("The Moon Illusion", *A Ilusão da Lua*), and started a YouTube Channel ("Reciprocal Space", *Espaço Recíproco*), to discuss the importance of Science and Education for the future of the humanity. I enthusiastically believe in the strength of networking and dialog. In addition to that, I am (and was) highly active in many commissions, boards, and networks.



More recently, I was elected by peers to be on the board of the Brazilian Association for the Advancement of Science (*Sociedade Brasileira para o Progresso da Ciência, SBPC*), President of the Board of the Principia Institute (Instituto Principia), Senior Fellow of the International Association of Universities (IAU), and in the governing board of Magna Charta Observatory (MCO). I am an active member of the Brazilian Academy of Sciences (*Academia Brasileira de Ciências*). I also served as an advisor for international partnerships at the São Paulo State Foundation for Research Support (FAPESP), where I had the opportunity to chair symposiums and workshops in several countries, including USA, Canada, Spain, Japan, United Kingdom, China, and Germany.

I currently hold the titles of IEEE Senior Member and AdCom Member of IEEE Magnetics Society. Since 2020, I have been collaborating with MagSoc Technical Committee, I will be transferring the expertise that I have acquired throughout my career as a scientist and a leader of complex organizations in higher education, to the success of the IEEE Magnetics Society.



² More information is available under www.mc.unicamp.br

The IEEE Magnetics
Summer School's
Journey:

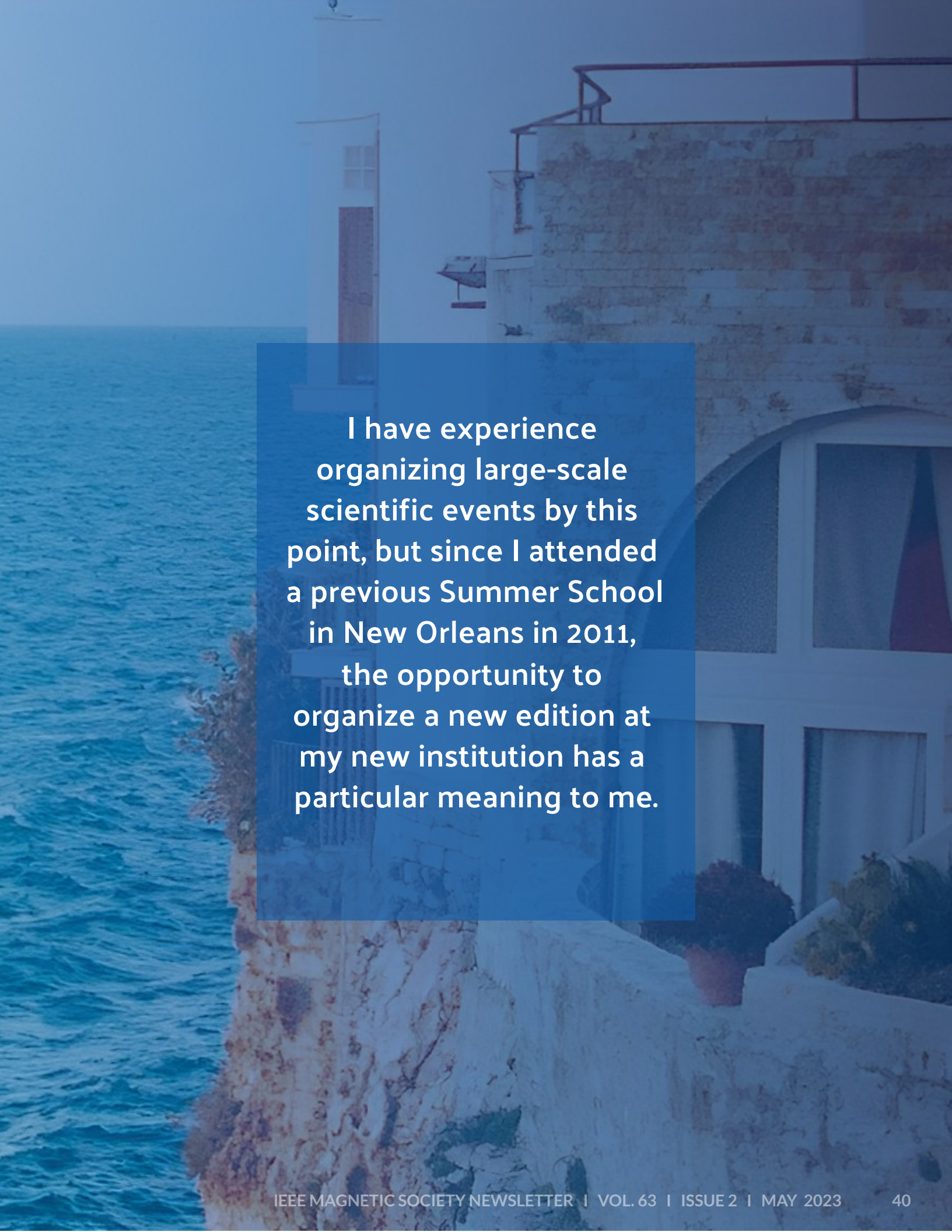
from student to director

by Vito Puliafito
Italy Chapter Chair &
Co-director of 2023
IEEE Magnetics Society
Summer School


The IEEE Magnetics Society Summer School has a successful history, starting in 2008 in Colorado Springs, USA. It was then organized every year until 2019 in many other countries of the world, including Spain, Japan, Brazil, Ecuador, Germany, India, and China. In 2023, it will return to Italy for the second time since 2013 in Assisi.

I am writing this article from my office at the Politecnico di Bari, Italy, where I was lucky to get the position of associate professor in electrical engineering less than two years ago. I have just sent an important update to all the students participating in the next edition of the IEEE Magnetics Society Summer School, which will be hosted by the Politecnico after a long break due to the COVID-19 pandemic.

Being the co-director of this Summer School, together with my longstanding colleague and friend Giovanni Finocchio, I feel very honored, but the position also comes with many responsibilities. Next June, we will host almost one hundred students from all over the world who will come to the beautiful region of Apulia, a few kilometers from Bari, to experience the local culture whilst also learning about magnetism research topics and of course, enjoying being students.



I have experience organizing large-scale scientific events by this point, but since I attended a previous Summer School in New Orleans in 2011, the opportunity to organize a new edition at my new institution has a particular meaning to me.




In the recent months, I've been able to organize better thanks to my memories of that Summer School experience. I applied to the School in New Orleans at the end of 2010, just a few months before my Ph.D. defense. In May 2011, the amazing city of jazz, Mardi Gras, and the French Quarter welcomed me as a recent Ph.D. graduate, eager for new experiences and scientific advancement. I can recall many details of that School, and numerous anecdotes. I will never forget the excitement I felt during the welcome of the organizers, especially when they showed a slide with the data statistics on the origins of the students; there were 100 students, and in the pie chart 1% of them was coming from Italy, that was just me.

**I had the impression that
I was in the right spot at the
right time from a scientific
standpoint.**

During my Ph.D., I did a lot of research on micromagnetics related to spintronics. At the School, I was able to expand my knowledge on the fundamentals of magnetism and gain a broad overview of several applications, neither of which had been the focus of my prior studies. The constant interaction with other students working in diverse fields of research—many of whom have evolved into collaborators over the years, if not friends—further stimulated this opportunity. During the poster session, I presented my work about the nonlinear model of analog modulation tested by means of numerical simulations on a spin-torque modulator. It was very exciting to get questioned by the same students with whom I had begun to form friendships.

**Spending
a week of lectures
and social activities
with them was
undoubtedly a life-
changing experience
for both my personal
and professional
development.**



Indeed, social activities play a key role in any scientific event as they allow participants to interact outside of the usual research environments and schemes. New Orleans offered us a huge variety of experiences that became unforgettable memories: the beautiful dinner on the riverboat navigating the Mississippi, the Greek-style festival, the rugby matches among the students, and the night in the French Quarter listening to a live jazz concert.

These memories overlap with my current responsibilities because they motivate me to organize a renewed opportunity for the next generation of scientists who will define the next frontiers of magnetism to grow personally and scientifically. Since 2011, numerous advancements have been made in magnetism research—for example, the discovery of new materials, new spin-related effects, the ability to obtain ultra-fast magnetic dynamics, and the applications of magnetism for cutting-edge biomedical challenges or unconventional computing applications.


**We will explore these topics,
along with fundamentals, theory,
simulations, and experiments
related to magnetism at the
School next June.**

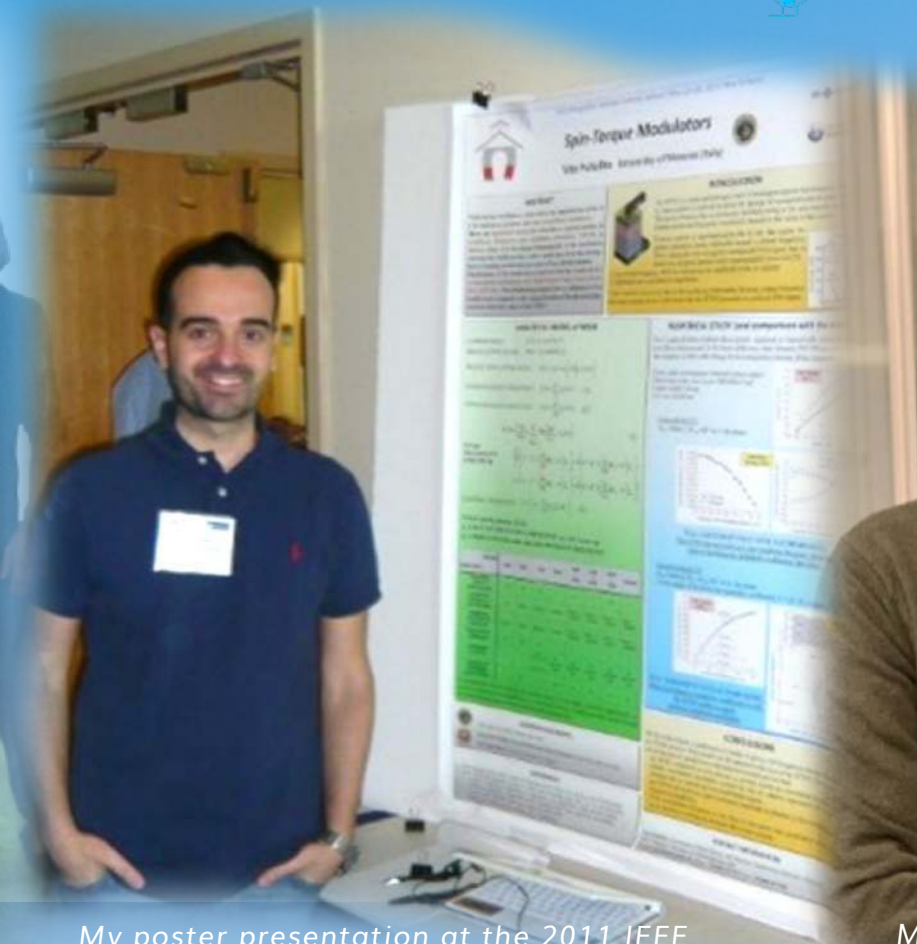
The 2023 edition of the School, whose history was interrupted for a considerable amount of time by the COVID-19 pandemic, marks a fresh beginning for the Magnetics Society. More than ever, we should emphasize that research is enjoyable only when shared and that students attending the upcoming School will have another chance to do it in person. For this reason, we will encourage their interactions during lectures and through social activities, which will be abundant in the stunning setting of the Riva Marina Resort.



Group picture of some students of the 2011 School after a rugby match



Here in Bari, spring has arrived; despite the fact that it is now 7 o'clock in the evening, the sky is still bright outside. There is a lot to do before the start of the School. We are working constantly with the great support of IEEE Magnetics Society Education Committee with specific objectives. May the students coming to the upcoming School have the opportunity to forge good, long-lasting memories and enrich themselves through scientific collaborations and friendships. May one of them be lucky enough to lead one of the IEEE Magnetics Society Summer Schools in the future. 



My poster presentation at the 2011 IEEE Magnetics Summer School



Me in the office at the Politecnico di Bari

For more
information
about the 2023
IEEE Magnetics
Summer
School:



official page



Supplementary page by the
local organizers including
further details



How to Maximize Your Conference Experience

by Martin Lonsky

Institute of Physics, Goethe University Frankfurt, Germany

As an active researcher in experimental condensed matter physics and magnetism who has attended approximately 20 conferences, I believe my experience has enabled me to share some ideas on how to maximize the benefits of any conference, regardless of whether you are a young and inexperienced researcher or a seasoned professional.

1 Choose the right conference and set goals

Conferences range from large-scale events like APS March Meeting, which just took place in Las Vegas with approximately 13 000 attendees, to more specialized gatherings with only a few dozen or a hundred attendees. Prior to signing up for a conference, it is a good idea to decide your goals and identify which meeting will help you get there.

Do you want to connect with new people in your specific subfield or gain new ideas from expert talks?

Are you planning to attend poster sessions where many present their first results?

Or do you want to see that famous Nobel laureate deliver a plenary talk?



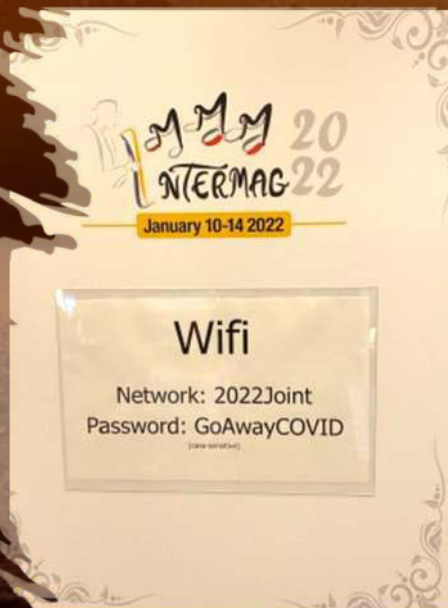
I have met too many people who attended a conference that did not meet their expectations, so please avoid this by planning ahead. Personally, I like to use large-scale conferences for developing new ideas based on presentations and interactions with people who may not work in my field, whereas I attend smaller, more specialized conferences with the goal of networking and bringing my work to the attention of other people in my research community. However, I would not be surprised if others have a different approach to this.

2 Planning is key

Purchase your flight ticket, make a hotel reservation, and apply for your visa well enough in advance. Visit the conference website and keep an eye on possible updates. Create a detailed schedule and do not hesitate to modify it over and over. Once you have arrived at the conference venue, familiarize yourself with the location, search for the WiFi password, and check out the speaker preparation room if you have an oral presentation.

Seen at the first in-person magnetism conference in the United States since the pandemic began: Joint MMM-Intermag 2022 in New Orleans.

A strong candidate for the "best WiFi password ever" prize and not too difficult to remember.



Sometimes it is advisable to plan on attending complete sessions (i.e., blocks of two to four hours packed with short talks). In certain cases, it may be preferable to jump between sessions and select specific talks that interest you. In any case, remember to take breaks! Especially as a graduate student, my conference schedule was jam-packed with myriad of presentations, but as I have established myself in the magnetism community, more networking events appear on my agenda, such as meeting past colleagues and advisors and taking part in receptions and dinners. That brings me to the third point.



Networking events such as welcome receptions offer a great opportunity to meet old and new friends.

3 Networking with other attendees

Talking to other attendees over lunch or during one of the numerous coffee breaks is crucial to making the most of your conference experience. Many people consider this the most important aspect of a conference — I agree for the most part, but it may depend on the type of conference and your role in the community.

If you are inexperienced or introverted, it can be helpful to prepare conversation starters and an elevator pitch. For example, if you found a talk interesting but didn't get the chance to talk to the speaker right away, consider sending them an email expressing your interest and suggesting a specific topic for discussion. Additionally, people may approach you based on the presentation you gave. As a matter of fact, I have even experienced that an engaging presentation in a suitable session may lead to new collaborations — in my case, a simple interaction at a conference had a major impact on the most important chapter of my Ph.D. thesis.

4 Consider using social media

This advice is certainly in line with the zeitgeist and perhaps a bit controversial. You will likely give an oral talk or present a poster at the conference you plan to attend, and it is obviously desirable to deliver an exciting presentation. There are many helpful resources that can assist you in preparing and delivering a captivating presentation, so I am not going to discuss this here. Instead, I want to draw attention to how social media helps to promote our work. A growing number of scientists are announcing their presentations on platforms like Twitter and LinkedIn, highlighting potentially fascinating sessions, and connecting with fellow attendees (before, during, and even after the conference).



I can therefore only recommend enhancing your social media profile and using those online networks to increase the visibility of your work.

5 Follow-up

Once the conference is over, go through your notes, write emails to the people you met, and consider presenting to your team colleagues about your conference experience. This is something I like to do regularly to motivate younger group members to rethink their approach to conference planning. Furthermore, it gives me a chance to report on the current hot topics in our field and share new ideas relevant to our own research with them. Lastly, my colleagues back at home always enjoy the photos I share with them when talking about my conference experience.

Bonus tip

Beware of predatory (or fake) conferences! Did you receive a random invitation to give a plenary talk at the World Congress on *Insert some buzzwords here,* which takes place on a cruise ship somewhere in the Caribbean for a reduced rate of "only" \$3,990 instead of \$4,000? Most likely, this will be a scam. Please make sure to do a background check if you are not familiar with the conference.

Finally, keeping these tips and tricks in mind can help you maximize your conference experience and ensure that you build lasting connections, gain new insights and ideas, and promote your work more effectively. So, plan ahead, network with other attendees, and remember to share your conference experience with your colleagues who did not attend.



Outdoor event at the APS March Meeting 2023 in Las Vegas, with the High Roller in the background.

Certainly an interesting choice for a conference venue and perhaps not ideal for everybody.



We would love to hear about your tips for a successful and productive conference experience! Do you prefer smaller or larger meetings? What was your most memorable experience at a scientific conference? Is there something that you would like to improve in order to make conferences more enjoyable? What do you think about virtual and hybrid conferences when comparing them to in-person meetings?

Please send an email to the author, Martin Lonsky, and we may include your response in one of our upcoming issues of the IEEE Magnetics Society Newsletter.





How on EARTH do we measure the EARTH's magnetic field?

by May Inn Sim, María Salvador and Audre Lai,
Students in Magnetism



In 2022, the Students in Magnetism (SiM) Team successfully launched the *MagnetisIM* outreach series, designed to engage and educate young students in careers and applications in magnetic-related technology through fun and interactive activities. *MagnetisIM 2022* engaged more than 200 students, active faculty members, and industry professionals around the world to explore phone magnetometers and the Earth's magnetic field measurement.



The Watchmaker and the Earth

Graham's and Gauss's achievements mark important milestones in the history of scientific discovery. SiM aims to inspire young students and the

A proud George Graham shows off SiM's map of measured Earth's magnetic field values.

The launch outreach event, "*MagnetiSiM 2022: How on EARTH do we measure the EARTH's magnetic field?*" welcomed curious students from all over the world to commemorate the 300th anniversary of George Graham's discovery of Earth's axial tilt. The well-known British watchmaker, whose brand of watches is still highly regarded, was the first to observe the rapid changes in the Earth's magnetic declination over a short period of time. His monumental achievement is believed to be the very first observation of a geomagnetic storm.

MagnetiSiM 2022 also celebrated the 190th anniversary of K. Friedrich Gauss's initial measurement of the Earth's magnetic field intensity, whose work served as a foundation for geomagnetism studies and established a benchmark for precise measurements of the Earth's magnetic field.

general public to appreciate the pioneers' work through the lens of modern magnetic sensor technology and become a member of citizen scientists by sharing their local Earth's magnetic field measurements with the world.

As a global outreach effort, the *MagnetiSiM* series reaches out to everyone, regardless of geographical location. But how could we ensure that everyone in the world could assess a magnetic sensor to measure the Earth's magnetic field?

Well, the answer lies in that very device that we cannot do without.



Dear reader, please do consider visiting our website to submit a value for your location! Quick measure instructions are available or you can skip the guided activities if you are a well-learned individual!

*Cheers,
The SiM Team!*

Our Pocket-Sized Labs

Smartphones - an integral part of our lives that has become indispensable. It helps us stay in touch with people who matter most in our lives whenever and wherever. As long as we can get a reliable internet connection, it enables us to hold all of human knowledge in the palm of our hands. Are we, however, really able to claim that we fully comprehend our dependable handy "companion" that is always within arm's reach?

Sensors in our smart phones



The smartphone camera may be one of the most utilized components of a smartphone. Well, we definitely have witnessed the ubiquitous phenomenon of TikTok and many other social media platforms.



An example of a smartphone's most fundamental feature is its "phone," which consists of an integrated microphone that enables the user to have the audio transmitted to the recipients. Did you know that this microphone can be used in a variety of ways? It could work as an applause meter to indicate how well received your presentation is. You could also use it to measure how aggravating your loved ones' persistent nagging is.



Another example of such sensors is the automatic brightness adjustment feature, which is something our eyes are constantly appreciative of. Smartphones can intelligently sense the brightness of the environment and adjust the screen brightness for eyes' viewing comfort, making scrolling through them before bed a common nightcap. Naturally, this function uses a brightness sensor to enable us to accurately gauge how bright a source or area is.



The Magnetometer in our Smartphones

What purpose do magnetometers in our smartphones serve? Compass functions, gaming, augmented reality, and navigation are just a few of the examples of uses for which its technology is used.

MagnetiSiM 2022: How on EARTH do we measure the EARTH's magnetic field comprises of activities which involve the use of our smartphones to measure the Earth's magnetic field at our location. This taps into the fact that we have a magnetometer embedded in our phones.



Measuring the Earth's Magnetic Field with our Smartphones

Due to market competition, consumers have a wide selection of brands and models to choose from. In line with this, the magnetometer in each of these smartphones differs accordingly. Participants of *MagnetiSiM 2022: How on EARTH do we measure the EARTH's magnetic field* are engaged hands-on to better understand the Earth's magnetic field with their smartphones thanks to the specially crafted activities that are simple to follow step-by-step online activities, worksheets, and in-person or webinar events.

The Map of Measured Earth's Magnetic Field Values Around the World

Within a period of four months between September 2022 (the initiation of *MagnetiSiM 2022*) and January 2023, the SiM team is pleased to report that the map has been embellished with measured values from the following countries: United States, Singapore, Spain, United Kingdom, Malaysia, Japan, South Korea, Italy, Taiwan, Guatemala, Netherlands, Russia, China, Vietnam, Jordan, India, Sri Lanka, and Egypt. You may find our up-to-date map on our website. We look forward to receiving more submissions soon!

MagnetiSiM 2022

In the short time since the establishment of SiM in 2022, the team is proud to report three successful events from **Magnetism 2022** that took place all over the world. We are grateful for the support and collaboration from the IEEE Magnetics Society and local communities in making the events successful.



The Physics Professor's Suitcase of Traveling Science Wonders, Asia

September 2022



Prof Sow streaming from his office, which he customized it as a studio for experiments demonstration.

In September 2022, more than 200 students from all over Asia, ages 16 and under, were introduced to the Earth's magnetic field and **MagnetiSiM** at Professor Sow Chorng Haur's popular outreach series - *The Physics Professor's Suitcase of Traveling Science Wonders*. Professor Sow Chorng Haur, who has won multiple teaching awards for his keen and infectious teaching style, embraces technology to demonstrate fun with science to a young audience of mostly high school students from various countries in Asia. At this event, the students were given a glimpse of the Earth itself, including the magnetic marvels that make it tick.

Local Homeschooling Group Workshop, Ithaca, USA

October 2022



SiM's very own secretary and treasurer, Audre, bringing MagnetiSiM 2022 in the form of a workshop to aid high school students!

In October 2022, the SiM board member, Ya-An (Audre) Lai, collaborated with the **Cornell Center for Materials Research (CCMR) Outreach Committee** to develop learning materials for **MagnetiSiM 2022**. Audre further conducted a workshop or an Ithaca homeschooling group with the assistance of CCMR. Armed with a skillfully crafted worksheet and treats, Audre successfully led 11 students through a three-part workshop, exploring the magnetometers on their phones and visualizing the Earth's magnetic field. The workshop included a hands-on section, where the students explored the functionalities of various sensors on their phones. The workshop was marked as successful as the students provided positive feedback for discovering how easy and effective phone magnetometers are.

Bringing MagnetSiM to the World

As SiM is diligently working on MagnetSiM 2023, be assured that *MagnetSiM 2022: How on EARTH do we measure the EARTH's magnetic field* will remain active so that anyone and everyone can participate in the experience while SiM works on a new edition of the *MagnetSiM* series for 2023. On our [website](#), you can find information about the event, a submission form to submit measured values, and our interactive map.

We welcome anyone who wishes to bring the *MagnetSiM* series to their local communities, be it a workshop or an event, to reach out to us without hesitation, and we are more than glad to provide assistance, materials, and content.

We would also like to call on avid educators among our IEEE Magnetics Society community for learning pointers in our upcoming outreach efforts.

Additionally, we are open to any new ideas or feedback for SiM.



We invite our fellow graduate students in magnetism who share similar aspirations to join us in our mission. Simply drop us an email to express your interest!



Follow us for updates on ongoing events within the community.



Semana de la Ciencia (Science Week), Spain

December 2022



SiM's multi-talented deputy María (second from right), and her team after a job well done at *Semana de la Ciencia*.

The SiM team participated in the curated seminar *Estudiantes en Magnetismo* (Students in Magnetism), which jointly celebrated *Semana de la Ciencia* (Science Week) organized by the *Scientific Culture and Innovation Unit (UCC+I)*, University of Oviedo, Spain. Four invited speakers graced us with their presence at the *Sala de Grados* at *Campus de Gijón*, bringing the audience of students and professors an informative time about a variety of magnetism topics. These compelling talks covered a range of topics, including the work of the Earth's magnetic field in conjunction with MagnetSiM 2022, the use of ferroelectric materials in modern life, magnets and sensors, and the nature of magnetotactic bacteria and how they can be used to fight and cure illnesses. Seeing how magnetism studies can be applied to a variety of situations in our daily lives was undoubtedly eye-opening for the participants.

The SiM team will provide Japanese snacks in this special event. There are also opportunities to win prizes!



Special Session



12 - 2 PM
MAY 19 FRIDAY
ROOM C HAGI
CONFERENCE BUILDING

NEW!

by  **IEEE
MAGNETICS**

This special event is an opportunity for graduate students to connect with each other, build relationships, and potentially volunteer for outreach activities as part of the Students in Magnetism community!

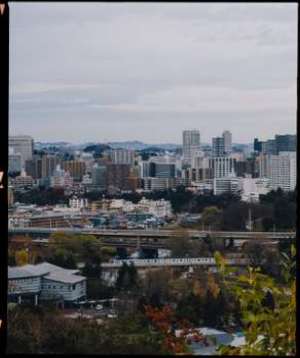
The two hour special session will consist of a presentation by SiM board members and Prof. Atsufumi Hirohata (President of IEEE Mag Soc) followed by two fun activities to get to know **your peers in magnetic-related research**.

Come learn about how to volunteer with us for outreach opportunities.

You will have the chance to **share your knowledge with others** and make a positive **impact on the world!**

Don't miss out on this incredible opportunity to connect with like-minded individuals and make a difference in the field of magnetics.

JOIN IEEE STUDENTS IN MAGNETISM TODAY!



INTERMAG 2023

SENDAI, JAPAN

INTERMAG 2023
will take place at the
Sendai International
Center, in Sendai, Japan,
May 15-19, 2023

Sendai is known as the “City of Green” and benefits from a beautiful natural environment, delicious food and unique hot springs. Early conference registration starts in February; **for further details about the conference please visit <https://intermag.org>**

We look forward to welcoming you to Sendai.

The Write Stuff:

Naughty

Naughty

Words

Words

WORDS

WORDS

Words

WORDS

WORDS



by **Ron Goldfarb**
President Elect
IEEE Magnetics Society

My favorite book on idioms is
**Scholastic Dictionary
of Idioms**
by Marvin Terban.

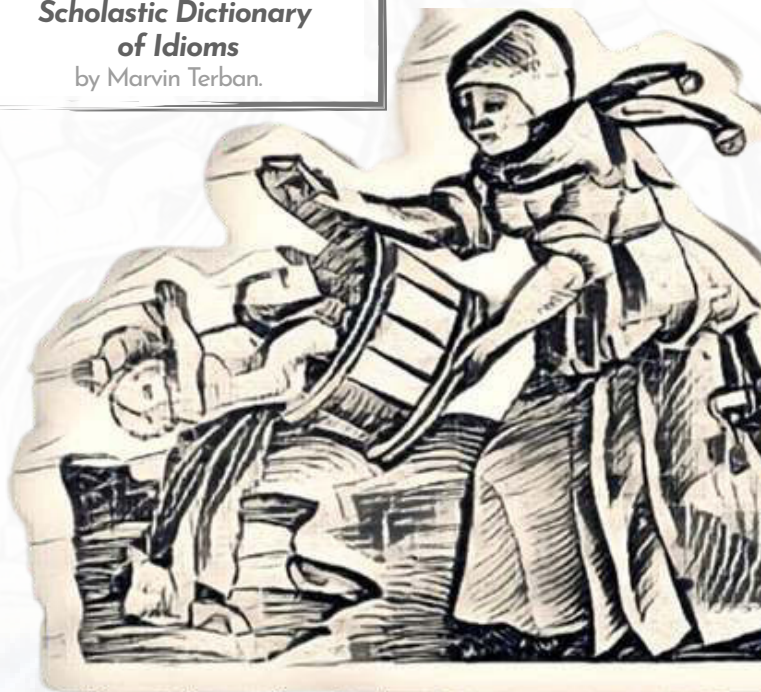


Image adapted from <https://commons.wikimedia.org/wiki/File:Murner.Nerrenbeschwerung.kind.jpg>

One member of our group often used idioms in conversation. While I escorted our foreign visitors, I would offer real-time translation.



Well, if you ignored the effect of mechanical strain on critical current, you'd be throwing the baby out with the bathwater."

GROUP MEMBER

English is rich with idioms: figurative expressions commonly understood in a region or a country. Mastery of idioms denotes cultural literacy. In America, many idioms are related to sports. Example: "The ball is in your court." (You can think of dozens more, right off the bat.)

Idioms are great to use in conversation with locals, but not so great when talking to non-native English speakers. We used to have many foreign visitors at my lab who were interested in our measurements on superconductors.

“Baby?”
FOREIGN VISITOR 1
(looking at me)

“Bathwater?”
FOREIGN VISITOR 2
(looking at me)

"If you ignored the effect of mechanical strain on critical current, there would be no reason to make the measurement."

RON

Lesson: When speaking (and writing) for an international audience, use standard English and generally avoid idioms. If you do use an idiom, explain it, as a way to help "drive home" your point.

Clichés are like idioms except the phrases are overused to the point where they have become trite. It has been said that Shakespeare was a good writer, except he used too many clichés. Clichés are expressions that have seen better days (*As You Like It, Act II, Scene VII*). Use them at the risk of being boring.

We have clichés peculiar to science writing, phrases that employ naughty words. By *naughty* I mean overused, vacuous words that mean naught.

I think the naughtiest word in science writing is



observe

Many authors love to observe. They think it makes their papers more scientific. They think it shows they are detached from their experiments; that they are dispassionate, unbiased, objective observers. (No danger of confirmation bias there.) For fun, I sometimes search articles for all occurrences of "observe."

Instead of observing, one can deduce, detect, determine, discover, find, identify, measure, note, notice, obtain, report, or see.

For experimentalists, *measure* is often an appropriate choice.

Here are some sample substitutions:

- this observation → this phenomenon
- is observed in → is measured in OR is apparent in OR occurs in OR is characteristic of
- this is typically observed in → this is typical in
- a minimum of the curve was observed at → the curve has a minimum at
- a negative peak is observed, which indicates → a negative peak indicates



- valence fluctuations have been observed in → valence fluctuations occur in
- has been observed when → takes place when
- this has also been observed in → this is also true in
- has been observed in this analysis → is evident in this analysis
- it was found that the observed phenomena were correlated with → the phenomena were correlated with
- coherence, observed in bulk Ni-Fe, has been observed to be modified when nanostructuring this alloy → coherence in bulk Ni-Fe is modified in nanostructures of this alloy

When possible, just delete them:

- the observed fluctuation amplitude → the fluctuation amplitude
- the observed effective reduction → the effective reduction
- this observation is in agreement → this is in agreement
- this observation is in agreement → this is in agreement
- the longest observed time → the longest time

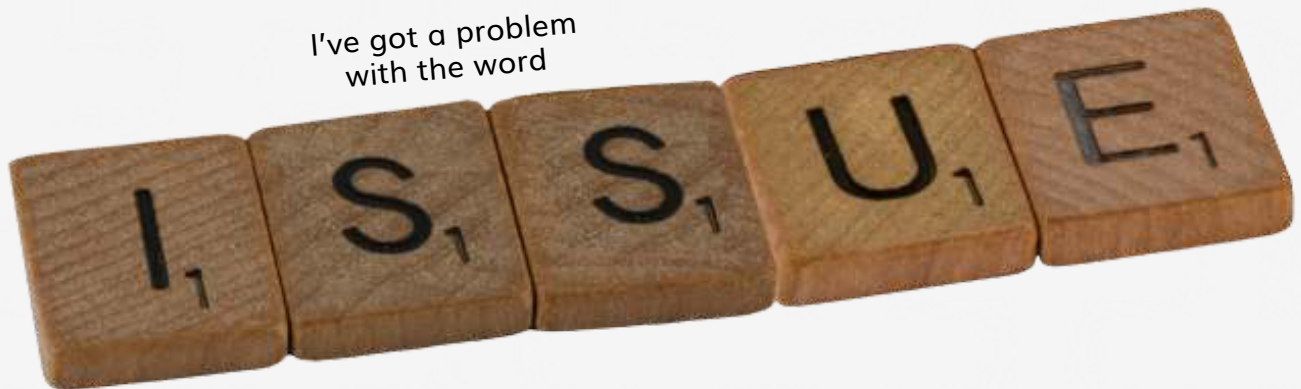
Two fields where
observation

may be used legitimately, I think, are astronomy and microscopy, where historically one used one's eyes.



Source: https://commons.wikimedia.org/wiki/File:Galileo_Galilei_1608-2008%3D400_anos_do_tlesc%C3%B3pio_-_panoramio.jpg

I've got a problem
with the word



Properly meaning a subject of discussion or controversy, an edition of a magazine or postage stamp, an exit or outlet, or progeny (in a legal sense), *issue* has become a word for all seasons, but mostly a euphemism for *problem*. If you search the websites of software companies, you may find a list of known issues, but never known problems. There are no problems, only *issues*.

Here are excerpts from a single memo from my organization written in 2003. For each instance of *issue*, I indicate a superior alternative.

... advise management on diversity-related **issues** [questions] ... while no overwhelming classism **issues** [problems] were apparent ... a consistently mentioned **issue** [topic] for those feeling less valued ... our response to the **issue** [situation] of people feeling less valued ... on the **issue** [subject] of micromanagement ... an important **issue** [factor] affecting staff perceptions ... apparently treated differently for one reason or another, perhaps because of diversity-related **issues** [considerations] ... follow up the survey with interviews to gain more insight into these **issues** [matters].

In my opinion, authors and speakers who reflexively use *issue* are lazy.

Below are other fashionable words and phrases worth avoiding:

- recently ... has attracted considerable interest
(Did you write this paper just because the subject is popular?)
- for next generation of ... *(If it is not practical now, how do you know it ever will be?)*
- we show for the first time *(Are you absolutely sure? And if true, does anyone really care?)*
- we created a new paradigm *(Fancy words that mean "improved method"?)*
- the technique is robust *(Maybe you really mean "reliable" and not "strong and healthy"?)*
- the precision is unprecedented *(Don't you really mean "improved"?)*
- we systematically measured *(Do you mean unlike your usual unsystematic measurements?)*

Colorful language and superlatives add interest, but not if they are past their expiration dates.



Adapted from The Write Stuff: Naughty Words, originally published in February 2022 in For Good Measure, the internal newsletter of the National Institute of Standards and Technology's Physical Measurement Laboratory.



I TOOK MY LEAP to pursue my goal in Science

by Vivian M. Andrade

Centro de Tecnologia da Informação Renato Archer, Brazil

Keep working on research, not just in magnetism; it is a tough task that should be pursued with passion and persistence. However, our passion and enthusiasm for what we do are not the only factors that motivate us; mental toughness also plays an important role in our daily struggles to persevere. As I embarked on this path, I gained some perspective on how to balance daily struggles with passion and perseverance.

I'm from Rio de Janeiro, Brazil, where I received my physics degree with the goal of working as a researcher in magnetic materials. I continued by pursuing Master's degree and studied the magnetic properties of nanostructured manganites though I had to struggle in the pursuit due to lack of funding, resources and equipment. What is worst to add is that I saw myself in a world of concepts I didn't fully comprehend; however, I kept on going to accomplish my research.

Growing up, my mom used to say to us:

se não for pra fazer direito, então não faça!

(If you're not going to do it right, then don't do it!)





I managed to finish my Masters program with two publications under my belt, and my supervisors, Prof. Mario Reis and Prof. Daniel Rocco, also suggested me the go-ahead to pursue Ph.D. studies. The opportunity to apply for an international scholarship for Ph.D. studies outside Brazil was one of the many options provided. By that time, I was only aware of a few friends who had studied abroad; since it is a very rare opportunity, it had never crossed my mind that it could be a possibility for me. So, my interest was piqued when I saw it laid out in front of me, and I thought, "Why not give it a shot?" So, through Mario, I met Prof. João Pedro and applied for a grant under the Brazilian "Ciências sem Fronteiras" program¹ ("Science without boundaries", similar to Erasmus) to perform my Ph.D. studies at University of Porto.



And Portugal was my first international stop, working on magnetic micro- and nanostructures!



Even though Portuguese is our shared first language, it took me a few months to understand the accent! Little did I realize that I was completely out of my comfort zone and that I should adapt to the new environment. Classes were conducted in English, which I knew little about. As a result, I enrolled in an English course and also had to quickly pick up scientific writing skills while also being able to deliver reports, papers, and presentations.

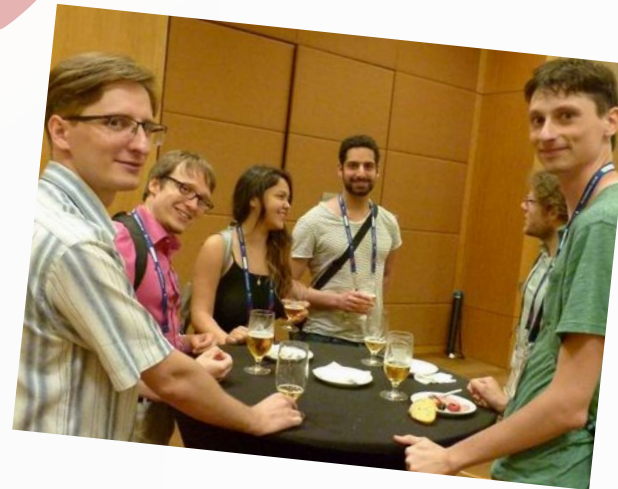
¹ Program was discontinued in 2017.

Next, I had to quickly adjust to the different work paces and cultures in the laboratories to access the resources I needed to advance my research. Despite this, I continued to face obstacles; one of them was that at the end of my first year, I realized that all the samples I produced had some kind of problem and that I should start all over again. There were difficult times that made me consider packing up and returning home. However,

by talking to my colleagues, I understood that my situation was not different from most of them and we could support each other on this path. With my mother's words in the back of my mind, I refocused on my objective by gathering myself back and relooking at my research from a different perspective. I conducted new experiments, and that all led me to develop a substantial amount of work ranging from bulk to micro-composites and nanoparticle magnetic systems by the end of my Ph.D.

And this has been an important stage in my growth as I have learned to be patient with myself, talk to others, share experience, and trust the process.

My subsequent international experience was InterMag 2018 conference in Singapore.



I had never been there before (along with the conference), so I had no prior acquaintance with any attendees. I was so nervous that I considered not giving my presentation. Fortunately, I ran into a friendly group of doctoral candidates who were encouraging one another's presentations and who gave me confidence in mine. My results were in the early stages, and this experience enabled me to realize that I could still present the work and engage in discussion with other researchers. This occasion, their questions and feedback were significant because it gave me the self-assurance I needed to complete my doctoral studies and apply for postdoctoral positions.

From this point, I understood the importance of integrating and participating not only with my research group but also researchers from other institutions to collaborate and exchange knowledge.



After my Ph.D., I got involved with the organizing committee of AtC-AtG Magnetics conference and the Workshop on i-Caloric Effects (WiCE), from which I felt glad to be more active and also expand my network. To go beyond the scientific community, I also participate in the M.A.F.A.L.D.A. project² to encourage high-school students on STEM (Science, Technology, Engineering and Math) through scientific activities (visiting facilities, workshop and seminars).

It is through these experiences that I have been able to inspire other girls to create and go after their dreams in the future.

² *Meninas na química, Física e engenharia para Liderar o Desenvolvimento em ciência* - Girls in Chemistry, Physics and Engineering to lead the science development

During this journey, I discovered (and still continue to discover) my strength, persistence and creativity as I accepted challenges as opportunities to learn from my struggles. Science is a collaborative effort and feedback can be solicited as encouragement: I have considered much feedback from people around me to help push myself to achieve the various milestones. For example, there were times I felt my ideas were good but others' criticism and opinions help me to see in a different perspective, from which I could find the open questions of my work to improve my papers. I took rejection in my stride though it may not always be what I wanted to hear, but it was sometimes what I needed to hear! By doing this, I picked up new skills, little by little, day by day.

Looking back, I am pleasantly surprised by accomplishing the objectives of my Ph.D., which help me to work on different projects along these years. I understood that I could occupy scientific territory not only as a woman but also as a Latina because others opened the door, and I am grateful for the brave researchers who came before me. After my Ph.D., I accomplished postdoctoral positions on different projects, from magnetic nanowires to prototyping a magnetic refrigerator. I applied for fellowships, and organized scientific events, expanded my network, and today I keep on going to achieve a permanent position. Writing this article has reminded me the courage and motivation it took to embark on my research path. It was my hope that by sharing my experience, it would encourage others to go forth and pursue our goals.

Vivian Andrade is a postdoctoral researcher at the Centre for Information Technology Renato Archer, in São Paulo, Brazil, studying thin films for integrated systems. She specializes in magnetic materials, ranging from bulk, micro, and nanostructures, for multifunctional applications, such as energy conversion, hyperthermia, and sensors.



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Figure 1. Key benefits offered to IEEE DataPort individual subscribers.



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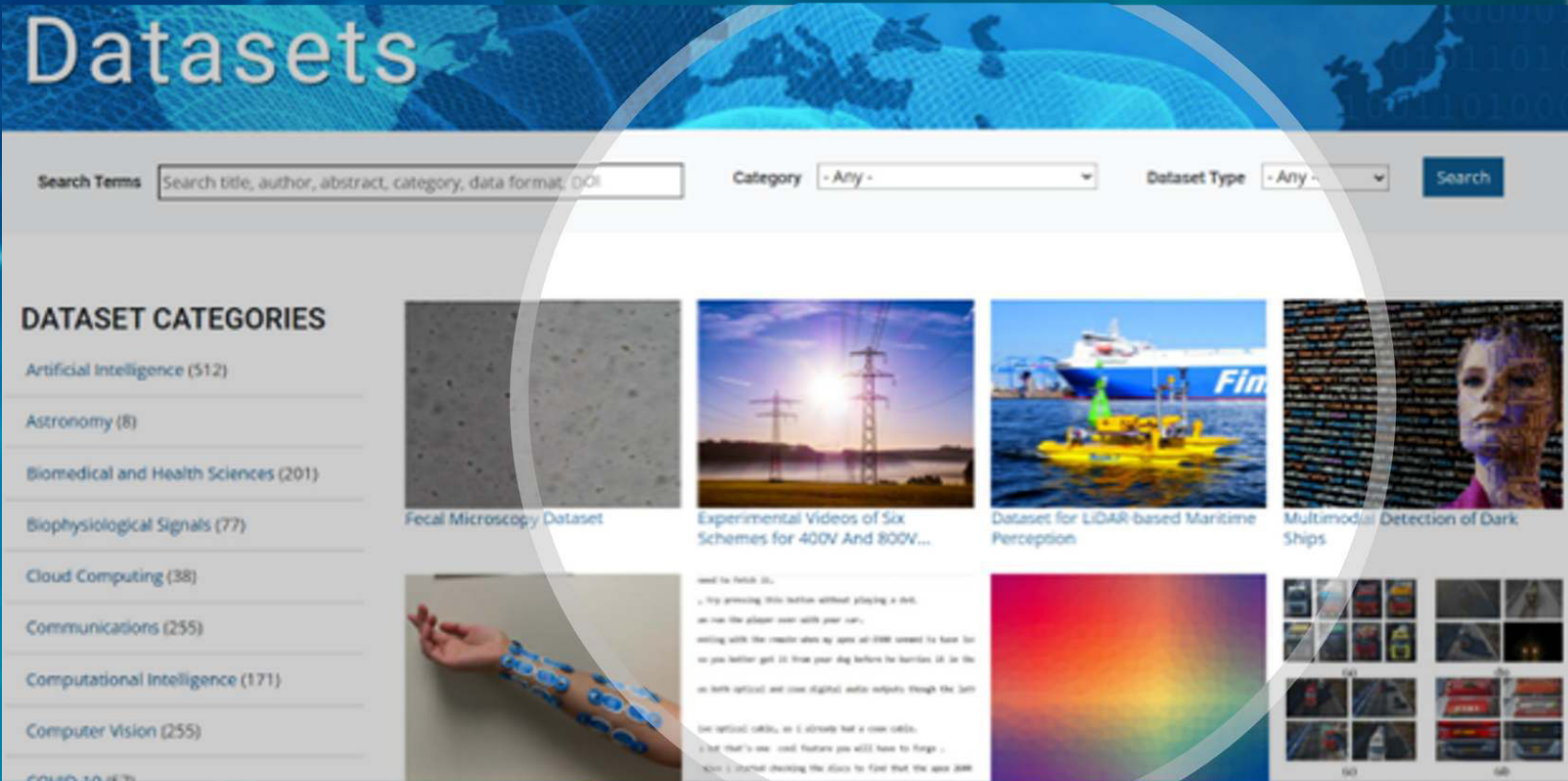


Figure 2. An example of the search functionality offered by IEEE DataPort.

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AWARDS & NOMINATIONS CALENDAR



2023 NOMINATIONS DUE



ANNOUNCED
ON DECEMBER 15

ANNOUNCED
ON DECEMBER 15



ANNOUNCED
ON DECEMBER 15

ANNOUNCED
ON DECEMBER 15



NOMINATIONS FORM +

CONFERENCE & SCHOOL CALENDAR

by Jia Yan Law
Newsletter Editor
IEEE Magnetics Society

International Network for Spintronics: Early Career Researchers Meeting
May 12 - 13, 2023
Sendai, Japan

INTERMAG 2023

May 15 - 19, 2023
Sendai, Japan

1st International Symposium on Integrated Magnetics 2023 (iSIM 2023)
May 14 - 15, 2023
Sendai, Japan

Physics of Magnetism 2023 (PM'23)
June 26 - 30, 2023
Poznań, Poland

34th The Magnetic Recording Conference (TMRC 2023)
July 31 - August 2, 2023
Minneapolis, USA

Magnonics 2023
July 30 - August 3, 2023
Paris, France

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24th International Conference on the Computation of Electromagnetic Fields (COMPUMAG 2023)
May 22 - 26, 2023
Kyoto, Japan

13th International Symposium on Hysteresis Modeling & Micromagnetics (HMM 2023)
June 5 - 7, 2023
TU Wien, Austria

MagIC + Magnetism, Interactions and Complexity: innovative ideas on spin wave dynamics and transport properties in low-dimensional materials
July 24 - 28, 2023
Będlewo, Poznań, Poland

The Joint Symposium
August 2 - 4, 2023
Madrid, Spain

Spin Caloritronics XII
May 22 - 25, 2023
Tsukuba, Japan

2023 IEEE Magnetics Society Summer School

June 11 - 16, 2023
Bari, Italy

To list your conference/events in the Newsletter Conference and School Calendar in a future edition, please contact the Editor.

26th
Soft Magnetic
Materials Conference
(SMM26)
September 4 - 7, 2023
Prague, Czech Republic

Trends in
MAGnetism 2023
(TMAG 2023)
September 4 - 8,
2023
Rome, Italy

XII
Latin American
Association of
Magnetism
(ALMA)
October 16 - 20
Puerto Varas, Chile

Petaspin 2023 School
on "Spintronics:
fundamentals and
applications"
December 11 - 15, 2023
Messina, Italy

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The European
School on
Magnetism 2023
(ESM 2023)
September 3 - 15, 2023
Madrid, Spain

10

Joint European Magnetic
Materials Conference
(JEMS2023)
September 27 - September 1, 2023
Madrid, Spain

11

68th
Annual Conference on
Magnetism and Magnetic
Materials
(MMM 2023)

October 30 - November 3, 2023
Dallas, USA

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IEEE
MAGNETICS



May 1

Registration opens

June 12

Invited talks
abstracts deadline

June 19

Poster abstracts
deadline

July 10

Early
registration ends

July 24

Manuscript
submission deadline



TMRC 2023

JULY 31 - AUGUST 2, 2023

University of Minnesota, Minneapolis, MN

<https://sites.google.com/umn.edu/tmrc2023/>

FEATURED

IEEE NEIL SMITH AWARD: TMRC PROMOTIONAL INFORMATION

IEEE Neil Smith Award for Contributions to the Understanding of Magnetic Phenomena in Materials and Devices

The inaugural IEEE Neil Smith Award will be presented at TMRC this year for the best contributed student posters. The IEEE award is in memory of Neil Smith, whose productive industrial research career was underpinned by a mastery of experimental measurement techniques and theoretical analysis. An award committee will select a separate winner from each of the two poster sessions. The two winners will each receive a \$1,000 cash prize. The winning posters need to be original contributions that contain an advance in the understanding of a technologically relevant physical system or phenomena. The selection criteria will be based on originality and impact of the material, as well as quality of the poster presentation.

Candidate Eligibility Criteria

- Undergraduate or Graduate Student
- Lead contributor and presenter of primarily their own work on a contributed poster

Required Submission Materials

- A brief justification on why the work should be considered for the award (less than 300 words)
- Letter of support for the student from a research advisor, who must be a member of the IEEE Magnetics Society.

Please indicate desire to be considered for the award when submitting the poster. Please send the award justification and letter of support to the IEEE Neil Smith Award chair (Michael Grobis, mkgrobis@ieee.org) before the poster submission deadline.

<https://sites.google.com/umn.edu/tmrc2023/>

Save the Date

MMM 20
23

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OCTOBER 30 -
NOVEMBER 3

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The purpose of the Newsletter of the IEEE Magnetics Society is to publicize activities, conferences, workshops and other information of interest to Society members, sister societies and other people in the area of applied magnetism.

Contributions are solicited from Society and sister society members, Officers & other volunteers, conference organizers, local chapters, and other individuals with relevant material. The Newsletter is published quarterly on the Society website at <http://www.ieeemagnetics.org>.

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Newsletter Editor, Jia Yan Law:
jylaw@ieee.org

CONTACT US:



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Newsletter Associate Editor
Martin Lonsky: mlonsky@physik.uni-frankfurt.de

