

# Activity Report

CIC biomaGUNE  
2015





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## Presentation

The Centre for Cooperative Research in Biomaterials - CIC biomaGUNE was officially opened in December 2006. CIC biomaGUNE is a non-profit research organization created to promote scientific research and technological innovation at the highest levels in the Basque Country following the BioBasque policy in order to create a new business sector based on biosciences. Established by the Government of the Basque Country, CIC biomaGUNE constitutes one of the Centres of the CIC network, the largest Basque Country research network on specific strategic areas, having the mission to contribute to the economical and social development of the country through the generation of knowledge and speeding up the process that leads to technological innovation.

The first phase for the setting of CIC biomaGUNE was to build laboratories to house up to 8 research teams. The scientific leaders were selected from the international scientific community. Along 2007 and 2008, the activity concentrated on building the Molecular Imaging Facility, which was approved as a National Facility by the Spanish Government in 2010. The Molecular Imaging Facility is a technological platform of high relevance at the European level in preclinical imaging. It empowers the research capacity at CIC biomaGUNE and provides high expertise service to research centres, hospitals and companies.

The appointment of Prof. Luis Liz-Marzán as new Scientific Director of CIC biomaGUNE in January 2013, settled the maturity of the Centre. Prof. Luis Liz-Marzán succeeds Prof. Manuel Martín-Lomas, who has been the Scientific Director in charge of founding and devising the initial structure of CIC biomaGUNE, from 2006 to end of 2012. His support has been essential to complete this transition, through shared duties and assistance to the Direction until his formal retirement in February 2015. Prof. Martín-Lomas will remain linked to the Centre as Founding Director and Advisor to the Direction.

Another event of major relevance has been the retirement of Prof. Soledad Penadés in February 2015, who was leading one of the most active groups in the Centre, which greatly contributed to a successful kick-off and establishment of CIC biomaGUNE's activities. Soledad not only continued some of her previous research lines but also made a huge effort in exploring the possibilities of her nanomaterials as bioimaging contrast agents and toward other applications in nanomedicine.

Also during 2015, two new research groups led by the Ikerbasque Research Professors Pedro Ramos Cabrer and Maurizio Prato have been created. Dr. Pedro Ramos Cabrer joined the MRI unit of CIC biomaGUNE in May 2014. His position has been consolidated in July 2015 with the award of the Ikerbasque Research Professorship. Prof. Maurizio Prato joined CIC biomaGUNE in October 2015. Prof. Prato, a world-leading scientist in the field of carbon nanomaterials, is leading the Carbon Nanobiotechnology Laboratory at CIC biomaGUNE.

CIC biomaGUNE has established a state of the art research program at the interface between the chemical, biological and physical sciences with a main emphasis on molecular scale properties and applications of biological nanostructures. The final aim of this programme is to contribute to the understanding of the functioning of biological systems at the molecular and nanometer scale. The main research lines are within

# PRESENTATION

the field of design, preparation and characterization of biofunctional nanostructures, to be used in the study of biological processes and the development of biomedical tools.

These research lines include the synthesis and characterization of biofunctional nanoparticles, studies on molecular self-assembly, nano-fabrication techniques toward nano-devices, bioconjugation of surfaces and study of interface processes, research on basic aspects of the interface design and the production of biologically relevant patterns at the nanometer scale for protein-surface and cell-surface interaction studies. This basic knowledge may permit, in the long run, to improve the ability to intervene at different stages of a disease by developing early diagnosis methods, “smart” treatments, as well as triggering self-healing mechanisms.

In June 2015, CIC biomaGUNE’s animal facility received the full accreditation from the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC). AAALAC full accreditation demonstrates our determination and ability to provide and maintain a high quality programme of laboratory animal care and use throughout the R&D activity.

An additional achievement has been the establishment of the Red Distribuida de Imagen Biomédica (ReDIB), integrated by TRIMA-CNIC and CIC biomaGUNE singular scientific and technical infrastructures (ICTS), which will offer services in the field of molecular, functional and anatomical imaging, covering from the preparation of contrast agents with application in different imaging modalities to their preclinical and clinical evaluation.

Finally, in September 2015 the scientific activity of CIC biomaGUNE was assessed by the International Scientific Advisory Board (ISAB). The ISAB is composed of internationally distinguished scientists who are active in CIC biomaGUNE’s research fields:

**Prof. Peter Morris** – Sir Peter Mansfield Magnetic Resonance Centre, University of Nottingham, UK

**Prof. Lia Addadi** – Weizmann Institute of Science, Rehovot, Israel

**Prof. Itamar Willner** – Institute of Chemistry, The Hebrew University of Jerusalem, Israel

**Prof. Helmuth Möhwald** – Max Plank Institute of Colloids and Interfaces, Golm, Germany

**Prof. Peter Seeberger** – Max Plank Institute of Colloids and Interfaces, Golm, Germany

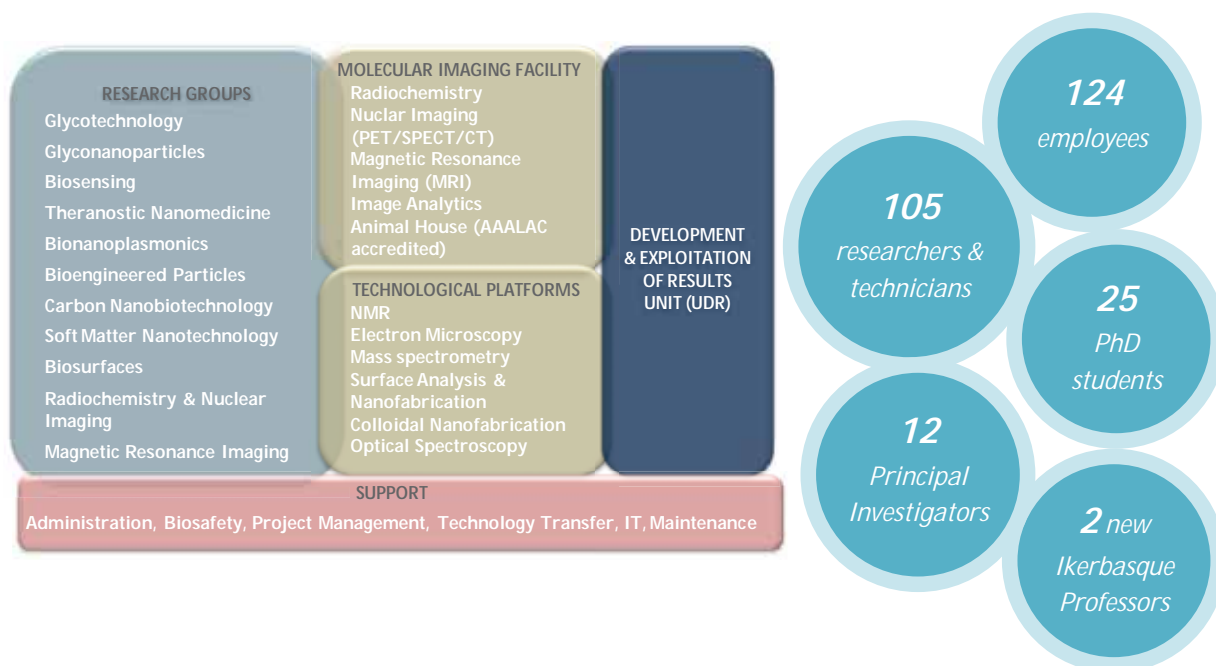
**Prof. Jon Dilworth** – Department of Inorganic Chemistry, University of Oxford, UK

**Prof. Samuel I. Stupp** – Institute for BioNanotechnology in Medicine, Northwestern University, USA

# SUMMARY

## Summary

### ORGANIZATION



### FUNDING

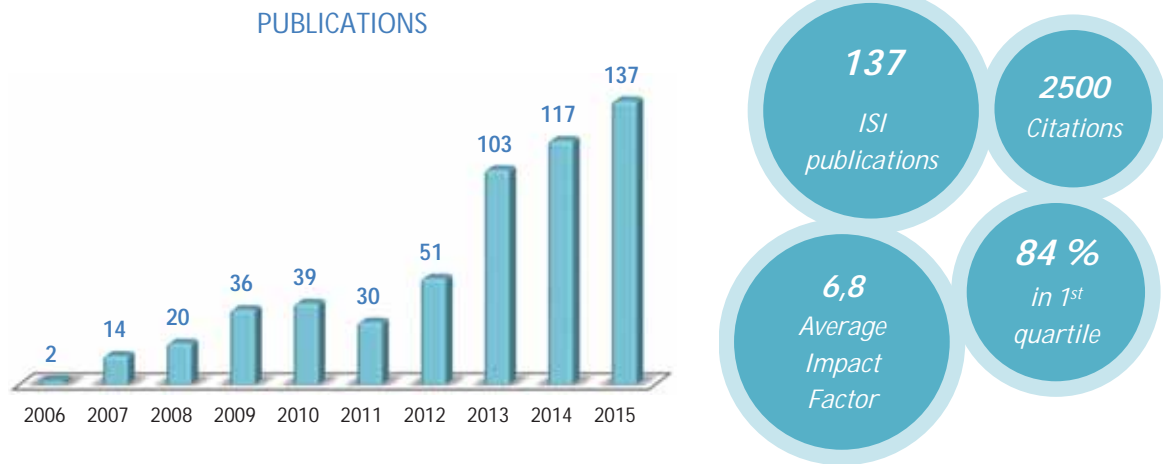
During 2015, 21 new grants have been awarded with a total contribution of 2,166,791.20€.



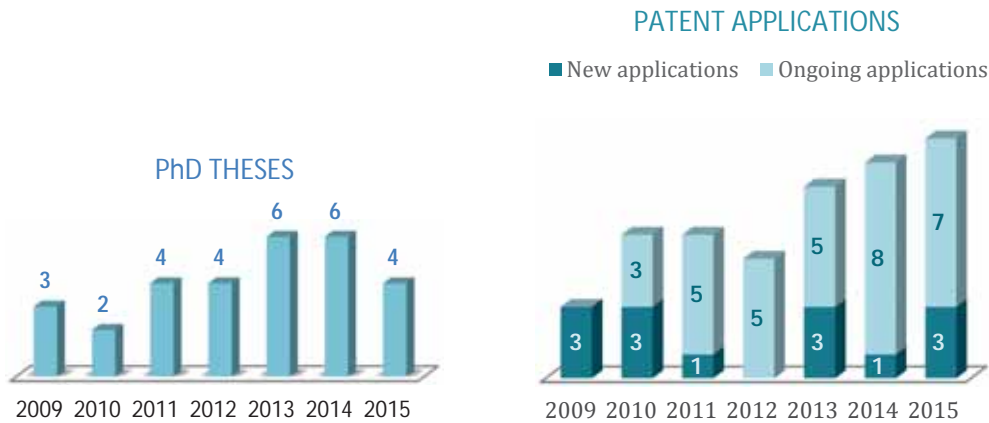
# SUMMARY

## SCIENTIFIC OUTPUT

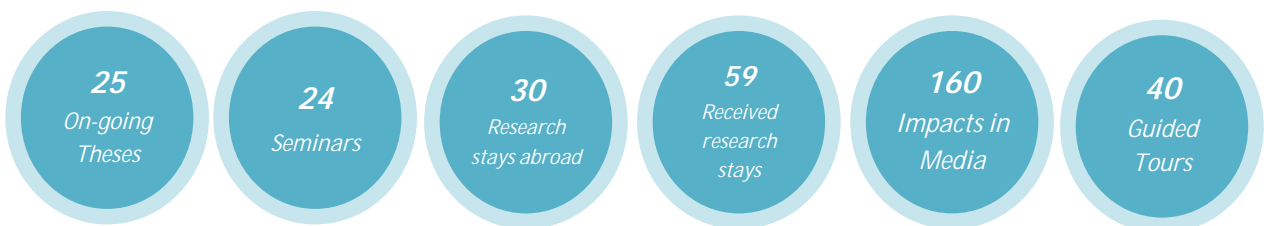
During 2015, 137 articles in high impact scientific journals have been published.



Also in 2015, 4 PhD theses have been defended and US and EP patent applications have been filed to pursue international protection for three inventions.



## TRAINING AND OUTREACH ACTIVITY



# ORGANIZATION

## Organization

The table below provides the distribution of CIC biomaGUNE's personnel as per November 2015.

### CIC biomaGUNE'S Personnel

Principal Investigators	11
Associate Researchers	7
Research Assistants	1
Platform Heads	9
Laboratory Technicians and Platform Specialists	30
Animal Caretaker	1
Postdoctoral researchers	22
PhD students	25
Direction and Administration	11
IT and Maintenance	7
Biosafety and Radioprotection	1
<b>Total</b>	<b>124</b>

## DEPARTURES AND RECRUITMENTS OF RESEARCH GROUPS

- **Prof. Soledad Penadés** research group's departure in February 2015 due to retirement.

Prof. Soledad Penadés has been one of the most active researchers in CIC biomaGUNE, making invaluable contributions toward the successful kick-off and establishment of the Centre's activities. Soledad not only continued some of her previous research lines but also made a huge effort in exploring the possibilities of her nanomaterials as bioimaging contrast agents and toward other applications in nanomedicine. We are glad that one of her major projects, namely participation in the CIBER-BBN network, will be continued with the participation of Niels Reichardt and Luis Liz-Marzán as principal investigators.

- **Prof. Manuel Martín-Lomas** departure in February 2015 due to retirement.

The retirement of Prof. Martín-Lomas will not involve closing of a research group, as the activity of the Glycotechnology Laboratory will be continued under the direction of Niels Reichardt. Manuel is in fact still in close contact with the group and participates in many discussions of results and new projects. His experience is also still of great value as Advisor to the Direction.



## ORGANIZATION

- **Pedro Ramos-Cabrer** joined the MRI laboratory in May 2014. Since July 2015 he is an Ikerbasque Research Professor and Group Leader at the same laboratory.

Dr. Ramos Cabrer graduated in 1994 in chemistry by the University of Santiago de Compostela. In 2000 he obtained a PhD from the Physical Chemistry of Colloids Laboratory, University of Santiago. In 2008 he obtained an MSc degree as expert in experimental animals for biomedical research, C Category by the University of Granada. He worked as postdoctoral researcher at the *in vivo* NMR Laboratory of the Utrecht Medical Centre (Utrecht) 05/2001-10/2003 and at the *in vivo* NMR Laboratory, Max Planck Institute for Neurological Research (Cologne) 12/2003-12/2006. After a long period abroad, he returned to Spain as Parga Pondal Researcher (Galician Government) at the Clinical University Hospital of Santiago de Compostela (12/2006-02/2010) and then as Miguel Servet Researcher (Spanish Ministry of Health) at the same hospital (02/2010-10/2014). He has been visiting researcher at the Laboratory of Nanomedicine of the Translational and Molecular Imaging Institute at Mount Sinai Hospital in New York (07-11/2013), collaborating docent of the Department of Medicine of the University of Santiago de Compostela (2008-2014) and member of the bioethics committee of the same university (2011-2014). He has an H-index of 22, 60 publications in indexed journals, 4 registered patents, 7 book chapters and over 98 conference presentations, courses and invited lectures. He has been principal investigator of 3 research grants of the Spanish National Plan, one from the ISCIII, one of Xunta de Galicia, and one from the Basque Government, and participated as a researcher in 2 RETICS networks and in 14 other grants.

- **Prof. Maurizio Prato** joined CIC biomaGUNE in October 2015 as an Ikerbasque Research Professor and new group leader.

Prof. Maurizio Prato received his "Laurea" degree in chemistry at the University of Padova, where he was appointed Assistant Professor in 1983. He moved to Trieste in 1992 as an Associate Professor, becoming Full Professor in 2000. He spent a postdoctoral year in 1986-87 at Yale University and was a Visiting Scientist in 1992-93 at the University of California. He has been visiting professor at the Paris Ecole Normale Supérieure, at the University of Namur and at the University of Strasbourg. Since 2013 he is Honorary Professor at the Xi'an Jiaotong University (China). In 2014 he received the honorary degree in Science and Technology of Materials from the University of Rome Tor Vergata. He has been awarded an ERC Advanced Grant (2008-2013), and received other prestigious awards such as the Federchimica Prize (1995), National Prize for research, Italian Chemical Society (2002), Gonzalez Ciamician, Spanish Chemical Society (2008), Medaglia Angelo Mangini (2009), Ree-Natta Lectureship, Korean Chemical Society (2010), Blaise Pascal Medal for Materials Science, EurAcadSci (2013), Natta Gold Medal, Italian Chemical Society (2014). Since 2010 he is Member of the Accademia Nazionale dei Lincei and since 2013 of the European Academy of Sciences. Prof. Maurizio Prato is a renowned scientist working on the development of functional carbon-based interfaces with enhanced performance in the field of biosensing and diagnostics. His group has a track-record expertise on preparation and functionalization of fullerenes, carbon nanotubes, graphene and their biomedical applications: nanotoxicity, drug delivery, diagnostics, neuronal regeneration. At CIC biomaGUNE he will be leading the Carbon Nanobiotechnology Lab that will focus on the development of functional carbon-based interfaces with enhanced performance in biosensing and diagnostics.

# ORGANIZATION

## RESEARCH GROUPS

During 2015 the following research groups have been active at CIC biomaGUNE:

## Group Leaders

**Glyconanoparticles**  
Soledad Penadés



**Glycotechnology**  
Niels Reichardt



**Biosensing**  
Valery Pavlov



**Theranostic  
Nanomedicine**  
Juan C. Mareque-Rivas  
**Ikerbasque Professor**



**BioNanoPlasmonics**  
Luis Liz-Marzán  
**Ikerbasque Professor**



**Bioengineered  
Particles**  
Wolfgang Parak



**Soft Matter  
Nanotechnology**  
Sergio E. Moya



**Biosurfaces**  
Ralf Richter



**Radiochemistry and  
Nuclear Imaging**  
Jordi Llop



**Magnetic Resonance  
Imaging**  
Torsten Reese



**Magnetic Resonance  
Imaging**  
Pedro Ramos-Cabrer  
**Ikerbasque Professor**



**Carbon  
Nanobiotechnology**  
Maurizio Prato  
**Ikerbasque Professor**



# ORGANIZATION

## Research Associates

### BioNanoPlasmonics

Marek Grzelczak  
Ikerbasque Fellow



### Bioengineered Particles

Mónica Carril  
Ikerbasque Fellow



### Heterogeneous Biocatalysis

Fernando López-Gallego  
Ikerbasque Fellow



### BioNanoPlasmonics

Javier Reguera  
Ikerbasque Fellow



### Glyconanoparticles

Isabel García-Martín  
CIBER-BBN



### Experimental Molecular Imaging

Abraham Martín-Muñoz



### Theranostic Nanomedicine

Luca Salassa  
Ramón y Cajal Fellow



# FUNDING

## Funding

During 2015, 21 new grants have been awarded with a total contribution of 2,166,971.20€.

### LIST OF FINANCED PROJECTS DURING 2015

PI	FUNDING AGENCY	CALL	AMOUNT	PERIOD	FULL TITLE
Fernando López Gallego	European Commission	H2020-MSCA-IF-2014	158,121.60	2015 - 2017	<b>NANOBIOENER</b> - NanoBio-inorganic generators for conversion of renewable chemical energy into electricity
Luis Liz-Marzán	European Commission	H2020-MSCA-IF-2014	158,121.60	2015 - 2017	<b>PHELLINI</b> - Plasmonic Heaters Linked to Lanthanide-Based Nanothermometers for Photodynamic Therapy in the Near-Infrared
Fernando López Gallego	MINECO	Explora Ciencia	40,000.00	2014-2016	<b>BIOPROTOGEL</b> - Solid phase cell-free peptide biosynthesis to manufacture therapeutic proteins
Ralf Richter	MINECO	Retos de la Sociedad - proyectos I+D	72,600.00	2015-2017	<b>SOFT and STICKY</b> - Cell adhesion at the soft blood vessel wall - coupling chemical and mechanical cues in immune cell recruitment, stem cell homing and tumour metastasis
Valery Pavlov	MINECO	Retos de la Sociedad - proyectos I+D	181,500.00	2015-2017	<b>ENCASE</b> - Enzymatic modulation of catalytical properties of nano objects and its application to biosensing
Niels Reichardt	MINECO	Retos de la Sociedad - proyectos I+D	283,140.00	2015-2017	<b>GLYCOIMMUNOTECH</b> - Tools to study and exploit the role of glycans in adaptive and innate Immunology
Juan Mareque	MINECO	Retos de la Sociedad - proyectos I+D	177,870.00	2015-2017	<b>ChemImmNP</b> - Development of Multi-functional Chemoimmunotherapeutic Nanomaterials to Treat Metastatic Cancer
Pedro Ramos/Torsten Reese	MINECO	Retos de la Sociedad - proyectos I+D	169,400.00	2015-2017	<b>UFMRI-Stroke</b> - Novel approaches for functional MR imaging at unprecedented temporal and spatial resolution: unveiling brain plasticity mechanisms in ischemia
Abraham Martín	MINECO	Proyectos de I+D+I para jóvenes investigadores	168,000.00	2015 - 2017	<b>IMAGlia</b> - The Yin and Yang of microglia following experimental stroke: an in vivo molecular imaging approach
Luis Liz-Marzán/Jordi Llop	MINECO	Redes Excelencia	137,000.00	2015 - 2017	<b>IMUTRANS</b> - Imagen multimodal y traslacional

# FUNDING

Vanessa Gómez	<b>MINECO</b>	Redes Excelencia		2015 - 2017	Metales en terapia y diagnóstico
Maurizio Prato	<b>MINECO</b>	Redes Excelencia		2015 - 2017	Red Flagship Grafeno
Sergio Moya/ Jordi Llop	<b>MINECO/ ERA-NET SIINN</b>	Acciones de Programación Conjunta Internacional	200,000.00	2015 - 2017	<b>FATENANO</b> - Translocación, destino biológico, estabilidad y dosis efectiva de nanomateriales para estudios de nanoseguridad
Carolina Carrillo	<b>MINECO</b>	Juan de la Cierva - Incorporación (RRHH)	64.000,00	2015 - 2017	
Eric Hill	<b>MINECO</b>	Juan de la Cierva - Formación (RRHH)	50,000.00	2015 - 2017	
Isabel García	<b>ISCIII</b>	Acción Estrategica de Salud (AES)	25.500	2015 - 2018	Desarrollo de una vacuna terapéutica Frente al VIH basada en una nueva formulación de MRNA con nanopartículas
Pedro Ramos	<b>GOBIERNO VASCO</b>	Proyectos de investigación básica y/o aplicada	39,200.00	2015-2018	Nanogeles de gelatina con actividad diagnóstica y terapéutica activable mediante acción enzimática
CIC biomaGUNE	<b>GOBIERNO VASCO</b>	Proyectos de Equipamiento	78,290.00	2015	Espectrómetro de masas con fuente de plasma de acoplamiento inductivo (ICP-MS) para detección y cuantificación de nanomateriales in vitro e in vivo
Jordi Llop	<b>GOBIERNO VASCO</b>	Ayudas a la organización de congresos	10,000.00	2015	1st International Workshop in Molecular Imaging
CIC biomaGUNE	<b>Diputación Foral Guipúzcoa</b>	Programa RED- Equipos	78,048.00	2015-2016	<b>TAQ</b> - Adquisición de equipamiento de análisis químico
Juan Mareque	<b>Diputación Foral Guipúzcoa</b>	Programa RED - Investigación	76,000.00	2015 - 2016	<b>Q+INMUNO T+D</b> - Evaluación Teragnostica por Imagen Nuclear de Nanoplataformas para Quimio e Inmunoterapia

# FUNDING

## RESEARCH AGREEMENTS WITH COMPANIES/INSTITUTIONS

During 2015 several collaboration agreements with the following companies/Institutions were in place:



# SCIENTIFIC OUTPUT – PUBLICATIONS

## Scientific Output

The scientific activity of CIC biomaGUNE during 2015 can be summarized as follows: 137 publications in high impact scientific journals, 4 PhD theses defended, and US and EP patent applications have been filed to pursue international protection for three inventions.

### COVER PAGES

#### Polymer Capsules as a Theranostic Tool for a Universal In Vitro Screening Assay—The Case of Lysosomal Storage Diseases

Nazareus, M.; Abasolo, I.; García Aranda, N.; Voccoli, V.; Rejman, J.; Cecchini, M.; Schwartz Jr., S.; Rivera Gil, P.; Parak, W.J.

*Part. Part. Syst. Charact.* **2015**, *32*, 991–998



#### Combination of HAADF-STEM and ADF-STEM Tomography for Core-Shell Hybrid Materials.

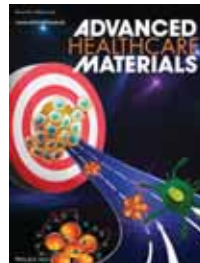
Sentosun, K.; Sanz Ortiz, M. N.; Batenburg, K. J.; Liz-Marzán, L. M.; Bals, S.

*Part. Part. Syst. Charact.* **2015**, *32*, 1063–1067

#### Regioselective Localization and Tracking of Biomolecules on Single Gold Nanoparticles

Rajeeva, B. B.; Hernandez, D. S.; Wang, M.; Perillo, E.; Lin, L.; Scarabelli, L.; Pingali, B.; Liz-Marzán, L. M.; Dunn, A. K.; Shear, J. B.; et al.

*Adv. Sci.* **2015**, 1500232



#### An Iron Oxide Nanocarrier Loaded with a Pt(IV) Prodrug and Immunostimulatory dsRNA for Combining Complementary Cancer Killing Effects

Hernández-Gil J., Cobaleda-Siles M., Zabaleta A., Salassa L., Calvo J.; Mareque-Rivas J. C.

*Adv. Healthc. Mater.*, **2015**, *4*, 1034 – 1042

#### Au@pNIPAM SERRS Tags for Multiplex Immunophenotyping Cellular Receptors and Imaging Tumor Cells

Bodelón, G.; Montes-García, V.; Fernández-López, C.; Pastoriza-Santos, I.; Pérez-Juste, J.; Liz-Marzán, L. M.

*Small* **2015**, *11*, 4149–4157



#### Stabilization and Encapsulation of Gold Nanostars Mediated by Dithiols

Wang, Y.; Serrano, A. B.; Sentosun, K.; Bals, S.; Liz-Marzán, L. M.

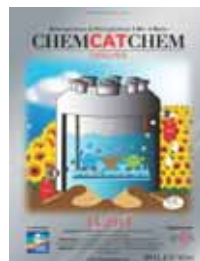
*Small* **2015**, *11*, 4314–4320

## SCIENTIFIC OUTPUT – PUBLICATIONS

**Selective Biomineralization of  $\text{Co}_3(\text{PO}_4)_2$  -Sponges Triggered by His-Tagged Proteins: Efficient Heterogeneous Biocatalysts for Redox Processes**

López-Gallego, F.; Yate, L.

*Chem. Commun.* **2015**, *51*, 8753–8756



**Immobilizing Systems Biocatalysis for the Selective Oxidation of Glycerol Coupled to In Situ Cofactor Recycling and Hydrogen Peroxide Elimination**

Rocha-Martin, J.; Acosta, A.; Guisan, J. M.; López-Gallego, F.  
*ChemCatChem* **2015**, *7*, 1939–1947

**Targeted Diagnostic Magnetic Nanoparticles for Medical Imaging of Pancreatic Cancer**

Rosenberger, I.; Strauss, A.; Dobiasch, S.; Weis, C.; Szanyi, S.; Gil-Iceta, L.; Alonso, E.; González Esparza, M.; Gómez-Vallejo, V.; Szczupak, B.; et al.

*J. Control Release* **2015**, *214*, 76–84



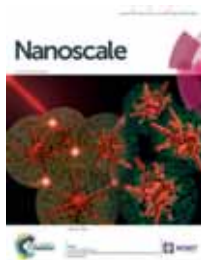
**Engineering Structural Diversity in Gold Nanocrystals by Ligand-Mediated Interface Control**

Wang, Y.; Sentosun, K.; Li, A.; Coronado-Puchau, M.; Sánchez-Iglesias, A.; Li, S.; Su, X.; Bals, S.; Liz-Marzán, L. M.  
*Chem. Mat.* **2015**, *27*, 8032–8040

**Multifunctional Self-Assembled Composite Colloids and Their Application to SERS Detection**

La Porta, A.; Sánchez-Iglesias, A.; Altantzis, T.; Bals, S.; Grzelczak, M.; Liz-Marzán, L. M.

*Nanoscale* **2015**, *7*, 10377–10381



**Biogenic Synthesis of Metallic Nanoparticles and Prospects toward Green Chemistry**

Adil, S. F.; Assal, M. E.; Khan, M.; Al-Warthan, A.; Siddiqui, M. R. H.; Liz-Marzán, L. M.  
*Dalton Trans.* **2015**, *44*, 9709–9717

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Abdelmonem, A. M.; Pelaz, B.; Kantner, K.; Bigall, N. C.; del Pino, P.; Parak, W. J. **Charge and Agglomeration Dependent in Vitro Uptake and Cytotoxicity of Zinc Oxide Nanoparticles.** *J. Inorg. Biochem.* **2015**, *153*, 334–338.

Adil, S. F.; Assal, M. E.; Khan, M.; Al-Warthan, A.; Siddiqui, M. R. H.; Liz-Marzán, L. M. **Biogenic Synthesis of Metallic Nanoparticles and Prospects toward Green Chemistry.** *Dalton Trans.* **2015**, *44*, 9709–9717.

Ariza-Carmona, L.; Martin-Romero, M. T.; Giner-Casares, J. J.; Camacho, L. **Direct Observation by Using Brewster Angle Microscopy of the Diacetylene Polymerization in Mixed Langmuir Film.** *J. Colloid Interface Sci.* **2015**, *459*, 53–62.

Ariza-Carmona, L.; Rubia-Paya, C.; Garcia-Espejo, G.; Martin-Romero, M. T.; Giner-Casares, J. J.; Camacho, L. **Diacetylene Mixed Langmuir Monolayers for Interfacial Polymerization.** *Langmuir* **2015**, *31*, 5333–5344.

Bano, F.; Carril, M.; Di Gianvincenzo, P.; Richter, R. P. **Interaction of Hyaluronan with Cationic Nanoparticles.** *Langmuir* **2015**, *31*, 8411–8420.

Betanzos-Lara, S.; Chmel, N. P.; Zimmerman, M. T.; Barrón-Sosa, L. R.; Garino, C.; Salassa, L.; Rodger, A.; Brumaghim, J. L.; Gracia-Mora, I.; Barba-Behrens, N. **Redox-Active and DNA-Binding Coordination Complexes of Clotrimazole.** *Dalton Trans.* **2015**, *44*, 3673–3685.



## SCIENTIFIC OUTPUT – PUBLICATIONS

Bodelón, G.; Montes-García, V.; Fernández-López, C.; Pastoriza-Santos, I.; Pérez-Juste, J.; Liz-Marzán, L. M. Au@pNIPAM SERRS Tags for Multiplex Immunophenotyping Cellular Receptors and Imaging Tumor Cells. *Small* **2015**, *11*, 4149–4157.

Borisova, O. V.; Billon, L.; Richter, R. P.; Reimhult, E.; Borisov, O. V. pH- and Electro-Responsive Properties of Poly(acrylic Acid) and Poly(acrylic Acid)-*block*-Poly(acrylic Acid)-*grad*-Styrene) Brushes Studied by Quartz Crystal Microbalance with Dissipation Monitoring. *Langmuir* **2015**, *31*, 7684–7694.

Briggs, D. C.; Birchenough, H. L.; Ali, T.; Rugg, M. S.; Waltho, J. P.; Ievoli, E.; Jowitt, T. A.; Enghild, J. J.; Richter, R. P.; Salustri, A.; *et al.* Metal Ion-Dependent Heavy Chain Transfer Activity of TSG-6 Mediates Assembly of the Cumulus-Oocyte Matrix. *J. Biol. Chem.* **2015**, *290*, 28708–28723.

Brzezicka, K.; Echeverria, B.; Serna, S.; van Diepen, A.; Hokke, C. H.; Reichardt, N.-C. Synthesis and Microarray-Assisted Binding Studies of Core Xylose and Fucose Containing N-Glycans. *ACS Chem. Biol.* **2015**, 150223140732005.

Calderon-Gonzalez, R.; Marradi, M.; Garcia, I.; Petrovsky, N.; Alvarez-Dominguez, C. Novel Nanoparticle Vaccines for Listeriosis. *Human Vaccines & Immunotherapeutics* **2015**, *11*, 2501–2503.

Calle, L. P.; Echeverria, B.; Franconetti, A.; Serna, S.; Fernandez-Alonso, M. C.; Diercks, T.; Canada, F. J.; Arda, A.; Reichardt, N.-C.; Jimenez-Barbero, J. Monitoring Glycan-Protein Interactions by NMR Spectroscopic Analysis: A Simple Chemical Tag That Mimics Natural CH- Interactions. *Chem.-Eur. J.* **2015**, *21*, 11408–11416.

Carregal-Romero, S.; Guardia, P.; Yu, X.; Hartmann, R.; Pellegrino, T.; Parak, W. J. Magnetically Triggered Release of Molecular Cargo from Iron Oxide Nanoparticle Loaded Microcapsules. *Nanoscale* **2015**, *7*, 570–576.

Chiodo, F.; Enríquez-Navas, P. M.; Angulo, J.; Marradi, M.; Penadés, S. Assembling Different Antennas of the gp120 High Mannose-Type Glycans on Gold Nanoparticles Provides Superior Binding to the Anti-HIV Antibody 2G12 than the Individual Antennas. *Carbohydr. Res.* **2015**, *405*, 102–109.

Chiodo, F.; Marradi, M. Gold Nanoparticles as Carriers for Synthetic Glycoconjugate Vaccines. *Methods in molecular biology (Clifton, N.J.)* **2015**, *1331*, 159–171.

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Tan, G.; Kantner, K.; Zhang, Q.; Soliman, M. G.; del Pino, P.; Parak, W. J.; Onur, M. A.; Valdeperez, D.; Rejman, J.; Pelaz, B. **Conjugation of Polymer-Coated Gold Nanoparticles with Antibodies-Synthesis and Characterization.** *Nanomaterials* **2015**, *5*, 1297–1316.

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Wang, Y.; Sentosun, K.; Li, A.; Coronado-Puchau, M.; Sánchez-Iglesias, A.; Li, S.; Su, X.; Bals, S.; Liz-Marzán, L. M. **Engineering Structural Diversity in Gold Nanocrystals by Ligand-Mediated Interface Control.** *Chem. Mat.* **2015**, *27*, 8032–8040.

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Zheng, G.; Kaefer, K.; Mourdikoudis, S.; Polavarapu, L.; Vaz, B.; Cartmell, S. E.; Bouleghlimat, A.; Buurma, N. J.; Yate, L.; de Lera, Á. R.; *et al.* **Palladium Nanoparticle-Loaded Cellulose Paper: A Highly Efficient, Robust, and Recyclable Self-Assembled Composite Catalytic System.** *J. Phys. Chem. Lett.* **2015**, *6*, 230–238.

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Martín, A.; Vázquez-Villoldo, N.; Gómez-Vallejo, V.; Padro, D.; Soria, F.N.; Szczupak, B.; Plaza-García, S.; Arrieta, A.; Reese, T.; Llop, J.; Domercq, M.; Matute, C. **In vivo imaging of system xc- as a novel approach to monitor multiple sclerosis.** *Eur. J. Nucl. Med. Mol. Imaging* **2015**, 1-15.

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## SCIENTIFIC OUTPUT – PHD THESES

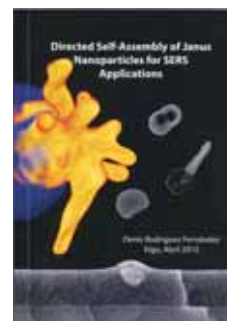
### PHD THESES

#### **Dr. Denis Rodríguez-Fernández**

Nanoparticle Assembly for Fabrication of SERS Codes

**Supervisor: Prof. Luis Liz-Marzán and Prof. Jorge Pérez Juste**

*Date: 30/04/2015*



#### **Dr. Dhruv Thakar**

Surfaces biomimétiques pour caractériser les interactions induites par les glycosaminoglycanes aux niveaux moléculaire, supramoléculaire et cellulaire

**Supervisor: Dr. Liliane Coche-Guerente, Dr. Ralf. P. Richter and Dr. Didier Boturyn**

*Date: 07/09/2015*



#### **Dr. Beatriz Macarena-Cobaleda**

Modular Multimodal Iron Oxide-Based Nanocarriers for Image-Guided dsRNA Immunostimulation and Platinum Anticancer Drug Design

**Supervisor: Prof. Juan Mareque Rivas**

*Date: 20/10/2015*



#### **Dr. Kiran B. Gona**

Exploring new labelling strategies for boronated compounds: towards fast development and efficient assessment of BNCT drug candidates

**Supervisor: Dr. Jordi Llop**

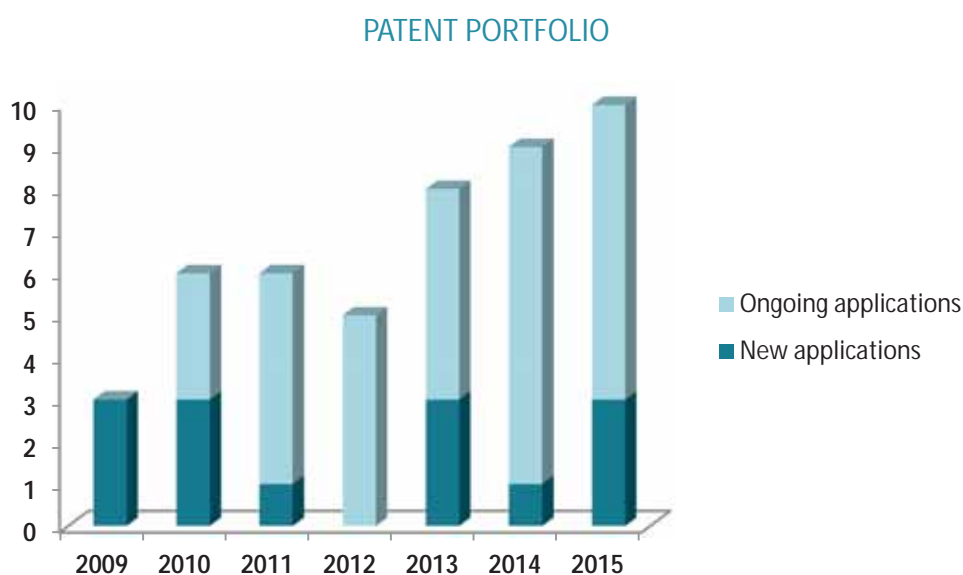
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# SCIENTIFIC OUTPUT – PATENT APPLICATIONS

## PATENT APPLICATIONS

The generation of patents is one of the instruments that indicate the transfer of knowledge from the Centre to the Society and to business development. The graph below shows the evolution over the years:



### 2015 Patent Applications

#### Cell Culture Support

L.M. Liz-Marzán, J.J. Giner-Casares, M. Henriksen-Lacey  
[EP15186375.0](#)

#### Diagnostic Methods and Devices

C. Lawrie, T. Schäfer, L. Basabe-Desmonts, W. Parak, L.M. Liz-Marzán  
[EP15193960.0](#)

#### Non-intrusive agitation system

M. Simon  
[US2015367303 \(A1\)](#); [EP2951452 \(A1\)](#)

# SCIENTIFIC OUTPUT – AWARDS & DISTINCTIONS

## RESEARCH AWARDS AND DISTINCTIONS

### Highly Cited Researchers

Luis Liz-Marzán, Wolfgang Parak and Maurizio Prato have been included in the new lists of Highly Cited Researchers (Thomson Reuters), in the fields of Chemistry (Liz-Marzán, Prato) and Materials Science (Liz-Marzán and Parak)

### 2015 *Rey Jaime I Award in Basic Research*

Awarded to Luis Liz-Marzán by the *King Jaime I Awards Foundation* in the category of Basic Research for his contributions to the field of Materials Science.

The King Jaime I Awards Foundation grants these awards annually since 1989, with the aim of stimulating scientific and business development, as well as social responsibility, while contributing to promoting international awareness of the national scientific and technological production.

### 2015 Correspondent Member of the Royal Spanish Academy of Sciences

Luis M. Liz-Marzán, has been elected correspondent member of the Royal Academy of Exact, Physical and Natural Sciences of Spain. The Royal Academy of Exact, Physical and Natural Sciences is a public body for the study of mathematics, physics, chemistry, biology and engineering, which is a part of the Institute of Spain.

### 2015 Georges Smets Chair

Awarded to Luis Liz-Marzán by Katholieke Universiteit Leuven and Université Catholique de Louvain

### 2015 Joseph Wang Award

Dr. Pedro Ramos-Cabrer awarded with the Joseph Wang Award 2015 in Nanoscience by the Cognizure publishing group.

### 2015 AAALAC Accreditation to CIC biomaGUNE's animal facilities

On June 18, 2015 CIC biomaGUNE received full accreditation from the Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC). The AAALAC full accreditation demonstrates CIC biomaGUNE's determination and ability to provide and maintain a high quality programme of laboratory animal care and use throughout the R&D activity. CIC biomaGUNE is one of the only seven organizations in Spain accredited by AAALAC, which places the Centre in a privileged position to participate in international research projects and collaborations with pharmaceutical and biotech companies, for which this accreditation is highly valued. AAALAC international is a private, nonprofit organization that enhances the quality of research, teaching, and testing by promoting human, responsible animal care and use through voluntary accreditation and assessment programs.

### Best Presentation/ Poster Awards

Ruta Grynite awarded for the best oral presentation at the 6th International Conference on Nanotechnology and Biosensors, December 15-16, 2015, Amsterdam, Netherlands.

Sameer M. Joshi awarded for outstanding poster for the work entitled "Preparation of <sup>13</sup>N-labelled polysubstituted triazoles via Huisgen cycloaddition", at the "21st International Symposium on Radiopharmaceutical Sciences, ISRS2015".

Ana Sánchez-Iglesias awarded with the best poster award at the "XXXV Biannual Congress from the Spanish Royal Society of Chemistry, RSEQ 2015" by the specialized group Nanomatmol for the work entitled "A General Approach Toward Polymer-Coated Plasmonic Nanostructures".

# SCIENTIFIC OUTPUT – EDITORIAL ACTIVITY

## EDITORIAL ACTIVITY



### Science

Board of Reviewing Editors – Luis Liz-Marzán



**Bioconjugate Chemistry** Advisory Scientific Board – Soledad Penadés

### Langmuir

Senior Editor – Luis Liz-Marzán

### ACS Nano

Associate Editor – Wolfgang Parak  
Editorial Advisory Board – Luis Liz-Marzán

**Chemistry of Materials** Editorial Advisory Board – Luis Liz-Marzán, Wolfgang Parak



### MetalloDrugs

Associate Editor – Luca Salassa

### Hybrid Materials

Editorial Advisory Board – Luis Liz-Marzán



### Nano Today

Advisory Board – Luis Liz-Marzán

### Colloids and Interface Science Communications

Advisory Board – Wolfgang Parak



**Journal of Carbohydrate Chemistry**  
Editorial Board – Manuel Martin Lomas

### Nanotoxicology

Editorial Board – Wolfgang Parak



### Nanomaterials

Editorial Board – Wolfgang Parak



**Scientific Reports**  
Editorial Board – Ralf Richter



### Journal of Materials Chemistry B

International Editorial Advisory Board – Luis Liz-Marzán



### Nanotechnology

Sensing and Actuators Editor – Luis Liz-Marzán



### ScienceJet

Associate Editor – Pedro Ramos



### Frontiers of Biomechanics

Editorial Board – Ralf Richter



### Theranostics

Editorial Board – Wolfgang Parak, Luis Liz-Marzán



### Angewandte Chemie

Editorial Board and International Advisory Board – Wolfgang Parak

### ChemistryOpen

International Advisory Board – Luis Liz-Marzán

### ChemNanoMat

International Advisory Board – Wolfgang Parak, Luis Liz-Marzán

### Advanced Optical Materials

International Advisory Board – Luis Liz-Marzán

### Particle & Particle Systems Characterization

Executive Editorial Board – Luis Liz-Marzán

Advisory Editorial Board – Wolfgang Parak

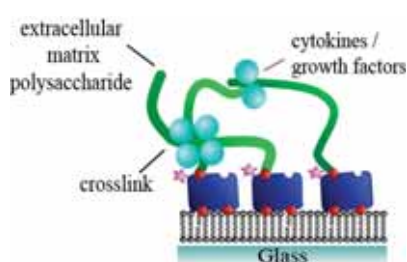
### Chemistry – A European Journal

Editorial Board – Luis Liz-Marzán

# SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

## RESEARCH HIGHLIGHTS

The Biosurfaces Lab in collaboration with research teams in Grenoble, Liverpool and San Diego, has demonstrated that extracellular signaling proteins can cross-link heparan sulphate, a sugar that fulfills important functions in the extracellular matrix



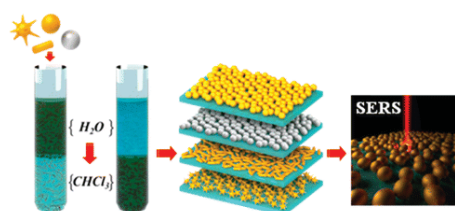
### Cytokines and Growth Factors Cross-link Heparan Sulfate

Migliorini, E.; Thakar, D.; Kühnle, J.; Sadir, R.; Dyer, D. P.; Li, Y.; Sun, C.; Volkman, B. F.; Handel, T. M.; Coche-Guerente, L.; Ferning, D. G.; Lorat-Jacob, H.; Richter, R.

*Open Biol.* **2015**, *5*, 150046

To test for cross-linking, the team developed a novel in vitro assay, based on well-defined films of end-grafted heparan sulphate (HS) as a model of HS-rich extracellular matrix and the combination of two biophysical analysis techniques: quartz crystal microbalance (QCM-D) and fluorescence recovery after photobleaching (FRAP). The study revealed that many (but not all) cytokines and growth factors cross-link HS, and that the cross-linking ability depends on the architecture of the HS binding sites. The ability of extracellular signaling proteins to differentially influence matrix organization and physico-chemical properties (e.g. permeability, rigidification, or proteoglycan clustering) implies that the functions of these proteins may not simply be confined to the activation of cognate cellular receptors. This may have far-reaching implications for cell-cell and cell-matrix communication, and the study makes predictions that can be tested in future cell and in vivo assays.

The BioNanoPlasmonics Laboratory at CIC biomaGUNE reports on a general route for transferring plasmonic nanoparticles from aqueous dispersions to other organic solvents readily forming nanoparticle assemblies



### A General Method for Solvent Exchange of Plasmonic Nanoparticles and Self-Assembly into SERS-Active Monolayers

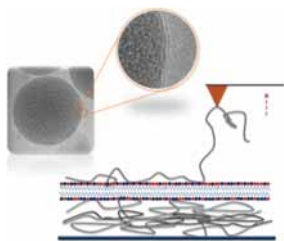
Serrano-Montes, A. B.; de Aberasturi, D. J.; Langer, J.; Giner-Casares, J. J.; Scarabelli, L.; Herrero, A.; Liz-Marzán, L. M.

*Langmuir* **2015**, *31*, 9205–9213

A general route for transferring plasmonic nanoparticles from aqueous dispersions into chloroform and other organic solvents has been developed, which can be applied to Ag and Au nanoparticles of arbitrary sizes and shapes, including spheres, nanorods, and nanostars. The transferred particles are stable in chloroform for months and can be readily dried, purified, and redispersed in various organic solvents. Whereas the self-assembly of plasmonic nanoparticles at liquid interfaces has been traditionally restricted due to limited size of nanoparticles available in organic solvents, limited stability, and complicated experimental procedures, the method proposed here allows us to obtain plasmonic nanoparticles in organic solvents with no restriction in size, shape, or surface chemical composition, readily forming nanoparticle assemblies which could in turn be transferred onto solid substrates. The dense close packing in the obtained nanoparticle monolayers results in extensive plasmon coupling, rendering them efficient substrates for SERS.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Soft Matter Nanotechnology Lab in collaboration with ULEI, report on the self-assembly of mixed vesicles on top of polyelectrolyte multilayers



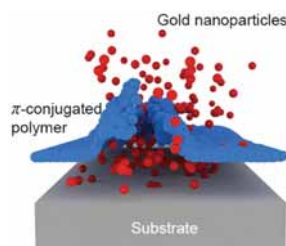
### Role of Hydrogen Bonding and Polyanion Composition in the Formation of Lipid Bilayers on Top of Polyelectrolyte Multilayers

Diamanti, E.; Cuellar, L.; Gregurec, D.; Moya, S.E.; Donath, E.

*Langmuir* **2015**, *31*, 8623 - 8632

The self-assembly of mixed vesicles of zwitterionic phosphatidylcholine (PC) and anionic phosphatidylserine (PS) phospholipids on top of polyelectrolyte multilayers (PEMs) of polyallylamine hydrochloride (PAH), as a polycation, and polystyrene sulfonate (PSS), as a polyanion, is investigated as a function of the vesicle composition by means QCM-D, Cryo-TEM, AFM and AFS. Vesicles with molar percentages of PS between 50 to 70 % result in the formation of lipid bilayers on top of the PEMs. Vesicles with over 50 % of PC or over 80 % of PS do not assemble into bilayers. AFS studies performed with a PAH modified cantilever approaching and retracting from the lipid assemblies reveal that the main interaction between PAH and the lipids takes place through hydrogen bonding between the amine groups of PAH and the carboxylate and phosphate groups of PS and with the phosphate groups of PC. The interaction of PAH with PS is much stronger than with PC. AFS measurements on assemblies with 50 % PC 50 % PS revealed similar adhesion forces to pure PS assemblies but the PAH chains can reorganize much better on the lipids as a consequence of the presence of PC. QCM-D experiments show that vesicles with a lipid composition of 50 % PC and 50 % PS do not form bilayers if PSS is replaced by alginate (Alg) or polyacrylic acid (PAA).

The BioNanoPlasmonics Laboratory in collaboration with researchers from Biodonostia and CIC nanoGUNE report on the remote release of nanoparticles from polymeric containers



### Conjugated Polymers As Molecular Gates for Light-Controlled Release of Gold Nanoparticles

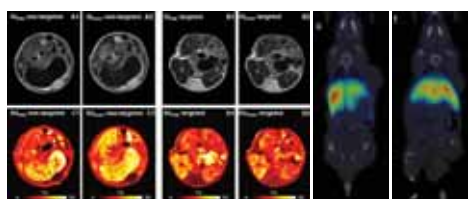
Sanromán-Iglesias, M.; Zhang, K. A. I.; Chuvilin, A.; Lawrie, C. H.; Grzelczak, M.; Liz-Marzán, L. M.

*ACS Appl. Mater. Inter.* **2015**, *7*, 15692–15695

The remote release of nano-objects from a container is a promising approach to transduce chemical events into an optical signal. The major challenge in the development of such a system involves the use of a suitable molecular gate that retains aggregated particles and releases them upon applying an external stimulus. We show proof-of-concept experiments for the release of gold nanoparticles into an aqueous solution upon photodegradation of conjugated polymer thin films. Gold nanoparticles thus transduce light-induced chemical events into an amplified optical signal with a release rate of 2.5 nM per hour, which can be readily detected by the naked eye.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Molecular Imaging Unit at CIC biomaGUNE, in collaboration with researchers from Goethe University and University of Heidelberg, Bar-Ilan University, Wilhelminenspital Vienna and Filarete Foundation report on the in vivo SPECT and MR imaging the diagnosis efficiency of targeted versus non-targeted nanoparticles in a murine pancreatic cancer model



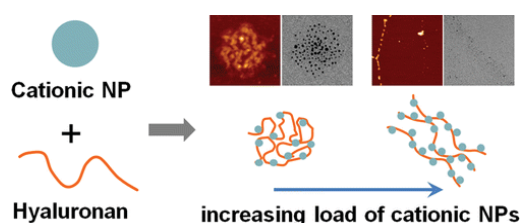
### Targeted diagnostic magnetic nanoparticles for medical imaging of pancreatic cancer

Rosenberger, I.; Strauss, A.; Dobiasch, S.; Weis, C.; Szanyi, S.; Gil-Iceta, L.; Alonso, E.; González Esparza, M.; Gómez-Vallejo, V.; Szczupak, B.; Plaza-García, S.; Mirzaei, S.; Israel, LL.; Bianchessi, S.; Scanziani, E.; Lellouche, J.P.; Knoll, P.; Werner, J.; Felix, K.; Grenacher, L.; Reese, T.; Kreuter, J., Jiménez-González, M.

*J. Control Release* **2015**, *214*, 76–84

Highly aggressive cancer types such as pancreatic cancer possess a mortality rate of up to 80% within the first 6 months after diagnosis. To reduce this high mortality rate, more sensitive diagnostic tools allowing an early stage medical imaging of even very small tumours are needed. For this purpose, magnetic, biodegradable nanoparticles prepared using recombinant human serum albumin (rHSA) and incorporated iron oxide (magnetite,  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub>) nanoparticles were developed. Galectin-1 has been chosen as target receptor as this protein is upregulated in pancreatic cancer and its precursor lesions but not in healthy pancreatic tissue nor in pancreatitis. Tissue plasminogen activator derived peptides (t-PA-ligands), that have a high affinity to galectin-1 have been chosen as target moieties and were covalently attached onto the nanoparticle surface. Improved targeting and imaging properties were shown in mice using single photon emission computed tomography-computer tomography (SPECT-CT), a handheld gamma camera, and magnetic resonance imaging (MRI).

The Biosurfaces and Glyconanoparticles Groups report on the interactions between the polyanionic polysaccharide hyaluronan and polycationic nanoparticles. It is found that stable and hydrated spherical complexes of single hyaluronan polymers with nanoparticles can be prepared when balancing the ionizable groups on hyaluronan and nanoparticles. The observed self-assembly phenomena could be useful for the design of drug delivery vehicles and a better understanding of the reorganization of HA-rich synthetic or biological matrices



### Interaction of Hyaluronan with Cationic Nanoparticles

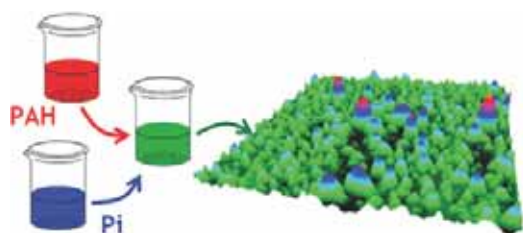
Bano, F.; Carril, M.; Di Gianvincenzo, P.; Richter, R. P. *Langmuir* **2015**, *31*, 8411–8420

Hyaluronan (HA) is a main component of extracellular matrix, and an attractive molecule for materials design in tissue engineering and nanomedicine. Moreover, HA being polyanionic, electrostatic interactions are clearly of importance for the self-organization and properties of hyaluronan-based materials. In this study, the authors apply a set of characterization techniques (quartz crystal microbalance, transmission electron microscopy and atomic force microscopy) to study the self organization of hyaluronan with small polycationic nanoparticles in aqueous environment. The results enhance our understanding of the profound re-organization of hyaluronan-rich biological and synthetic matrices by multiply charged nanoobjects. They also provide a route for the preparation of well-defined hyaluronan nanogel complexes with potential applications in materials science and nanomedicine.



## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Soft Matter Nanotechnology Laboratory reports on the formation of multifunctional supramolecular polyamine coatings in the presence of phosphate anions



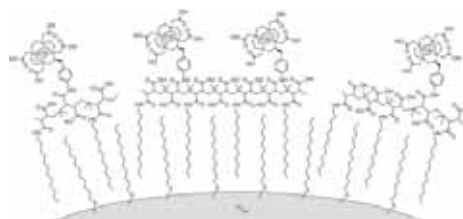
### Supramolecular Surface Chemistry: Substrate-Independent, Phosphate-Driven Growth of Polyamine-Based Multifunctional Thin Films

Marmisolle, W. A.; Irigoyen, J.; Gregurec, D.; Moya, S.; Azzaroni, O.

*Adv. Funct. Mater.* **2015**, *25*, 4144–4152

The ability to engineer surfaces at the supramolecular level by controlled integration of specific chemical units through substrate-independent methodologies represents one of the new paradigms of contemporary materials science. Here, a method is reported to form multifunctional supramolecular coatings through simple dip-coating of substrates in an aqueous solution of polyamine in the presence of phosphate anions. The chemical richness and versatility of polyamines are exploited as phosphate receptors to form thin functional films on a broad variety of substrates, ranging from metal to carbonaceous surfaces. It is shown that the simple derivatization of pendant amino groups of polyallylamine precursors with different chemical groups can endow films with predefined responsiveness or multiple functions—this translates into one-pot and one-step preparation of substrate-adherent films displaying built-in functions. It is believed that the flexibility, speed, and versatility with which this method provides such robust functional films make it very attractive for preparing samples of fundamental and technological interest.

The Bioengineered particles Lab led by Wolfgang Parak Lab, in collaboration with other European groups reports on the *in vivo* integrity of polymer-coated Au Nanoparticles



### In Vivo Integrity of Polymer-Coated Gold Nanoparticles

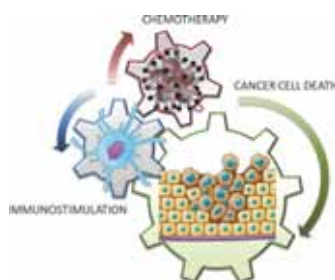
Kreyling, W. G.; Abdelmonem, A. M.; Ali, Z.; Alves, F.; Geiser, M.; Haberl, N.; Hartmann, R.; Hirn, S.; Jimenez de Aberasturi, D.; Kantner, K.; Khadem-Saba, G.; Montenegro, J.-M.; Rejman, J.; Rojo, T.; Ruiz de Larramendi, I.; Ufartes, R.; Wenk, A.; Parak, W.J.

*Nat. Nanotechnol.* **2015**, *10*, 619

Inorganic NPs are frequently engineered with an organic surface coating to improve their physicochemical properties, and it is well known that their colloidal properties may change upon internalization by cells. While the stability of such NPs is typically assayed in simple *in vitro* tests, their stability in a mammalian organism remains unknown. Here, we show that firmly grafted polymer shells around gold nanoparticles may degrade when injected into rats. We synthesized monodisperse radioactively labelled gold nanoparticles ( $^{198}\text{Au}$ ) and engineered an  $^{111}\text{In}$ -labelled polymer shell around them. Upon intravenous injection into rats, quantitative biodistribution analyses performed independently for  $^{198}\text{Au}$  and  $^{111}\text{In}$  showed partial removal of the polymer shell *in vivo*. While  $^{198}\text{Au}$  accumulates mostly in the liver, part of the  $^{111}\text{In}$  shows a non-particulate biodistribution similar to intravenous injection of chelated  $^{111}\text{In}$ . Further *in vitro* studies suggest that degradation of the polymer shell is caused by proteolytic enzymes in the liver. Our results show that even nanoparticles with high colloidal stability can change their physicochemical properties *in vivo*.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Theranostic Nanomedicine Lab reports the development and initial results with iron oxide nanoparticle-filled micelles size-selected for effective lymphatic delivery loaded with a cisplatin Pt(IV) prodrug and an immunostimulatory dsRNA (poly (I:C)) for targeted chemoimmunotherapy



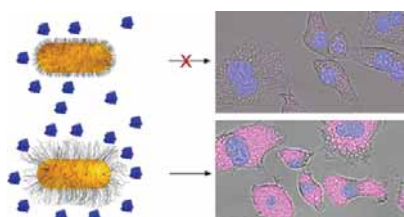
**An Iron Oxide Nanocarrier Loaded with a Pt(IV) Prodrug and Immunostimulatory dsRNA for Combining Complementary Cancer Killing Effects**

Hernandez-Gil, J.; Cobaleda-Siles, M.; Zabaleta, A.; Salassa, L.; Calvo, J.; Mareque-Rivas, J. C.

*Adv. Health. Mater.* **2015**, *4*, 1034–1042

There is major current interest in harnessing the immune system against cancer and in developing drugs that provide complementary cancer killing mechanisms. Although the recent advent of nanoparticle-based drug delivery systems have improved the efficacy of platinum drugs for chemotherapy, one of the fundamental paradigms in their design and use is evading surveillance by the immune system to enhance anticancer efficacy. Pt(IV) prodrug-modified PEGylated phospholipid micelles that encapsulate biocompatible iron oxide nanoparticles (IONPs) as a new delivery system for cisplatin are reported. The Pt(IV)-IONPs are functionalized with polyinosinic-polycytidylic acid (poly (I:C))—a double stranded RNA (dsRNA) analog widely used as an adjuvant in clinical trials of cancer immunotherapy. The Pt(IV)-IONPs and poly (I:C)-Pt(IV)-IONPs enhance by more than an order of magnitude the prodrug cytotoxicity in different tumor cells, while greatly increasing the ability of cisplatin and poly (I:C) to activate dendritic cells—the key cellular players in immunotherapy. The results suggest that these constructs hold promise for targeted chemoimmunotherapy

The laboratories of Soledad Penadés and Luis Liz-Marzán, members of the CIBER-BBN unit at CIC biomaGUNE, report on the use of Glycans as stabilizers and targeting units for plasmonic nanoparticles in biological media



**Glycans as Biofunctional Ligands for Gold Nanorods: Stability and Targeting in Protein-Rich Media**

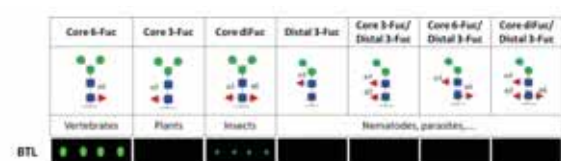
García, I.; Sánchez-Iglesias, A.; Henriksen-Lacey, M.; Grzelczak, M.; Penadés, S.; Liz-Marzán, L. M.

*J. Am. Chem. Soc.* **2015**, *137*, 3686–3692

Poly(ethylene glycol) (PEG) has become the gold standard for stabilization of plasmonic nanoparticles (NPs) in biofluids, because it prevents aggregation while minimizing unspecific interactions with proteins. Application of Au NPs in biological environments requires the use of ligands that can target selected receptors, even in the presence of protein-rich media. We demonstrate here the stabilizing effect of low-molecular-weight glycans on both spherical and rod-like plasmonic NPs under physiological conditions, as bench-marked against the well-established PEG ligands. Glycan-coated NPs are resistant to adsorption of proteins from serum-containing media and avoid phagocytosis by macrophage-like cells, but retain selectivity toward carbohydrate-binding proteins in protein-rich biological media. These results open the way toward the design of efficient therapeutic/diagnostic glycan-decorated plasmonic nanotools for specific biological applications.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Glycotechnology laboratory led by Niels Christian Reichardt in collaboration with researchers from CICbioGUNE, CERMAV, Universidade Federal do Ceará and Universität Bayreuth reported the specificity of a new lectin isolated from the alga *Bryothamnion triquetrum*



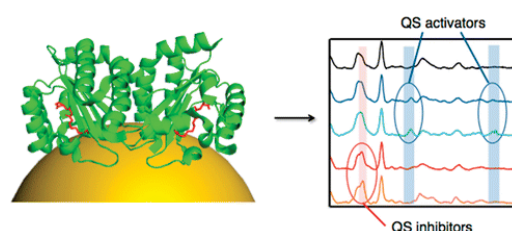
**Algal lectin binding to core ( $\alpha$ 1-6) fucosylated N-glycans: Structural basis for specificity and production of recombinant protein**

do Nascimento, A. S. F.; Serna, S.; Beloqui, A.; Arda, A.; Sampaio, A. H.; Walcher, J.; Ott, D.; Unverzagt, C.; Reichardt, N.-C.; Jimenez-Barbero, J.; Nascimento, K. S.; Imberty, A.; Cavada, B. S.; Varrot, A.

*Glycobiology* **2015**, *25*, 607–616

This paper describes the characterization of a lectin isolated from the red marine alga *Bryothamnion triquetrum* (BTL). After isolation and purification, the lectin was interrogated on glycan microarrays containing a collection of N-glycans with different fucosylation patterns. BTL showed a strict specificity towards core  $\alpha$ -1,6 fucose containing N-glycan structures and binding towards other types of fucose containing glycans was not observed. The interaction of BTL towards core  $\alpha$ -1,6 fucose containing N-glycan was further studied by titration microcalorimetry and by Saturation Transfer Difference Nuclear Magnetic Resonance (STD-NMR). The narrow specificity towards core  $\alpha$ -1,6 fucosylation convert BTL in a potential diagnostic tool, as this type of modification of N-glycans is an important biomarker in cancerogenesis and in the quality control of therapeutic antibodies.

The Bionanoplasmonics Laboratory in collaboration with University of Vigo, report on the use of SERS to analyze ligand-induced conformational changes in proteins



**Using Surface Enhanced Raman Scattering to Analyze the Interactions of Protein Receptors with Bacterial Quorum Sensing Modulators**

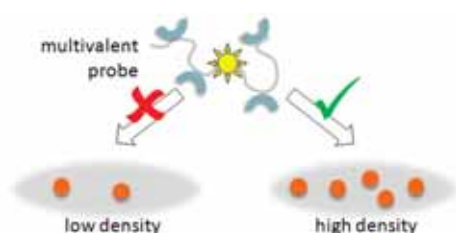
Costas, C.; López-Puente, V.; Bodelón, G.; González-Bello, C.; Pérez-Juste, J.; Pastoriza-Santos, I.; Liz-Marzán, L. M.

*ACS Nano* **2015**, *9*, 5567–5576

Many members of the LuxR family of quorum sensing (QS) transcriptional activators, including LasR of *Pseudomonas aeruginosa*, are believed to require appropriate acyl-homoserine lactone (acyl-HSL) ligands to fold into an active conformation. The failure to purify ligand-free LuxR homologues in nonaggregated form at the high concentrations required for their structural characterization has limited the understanding of the mechanisms by which QS receptors are activated. Surface-enhanced Raman scattering (SERS) is a vibrational spectroscopy technique that can be applied to study proteins at extremely low concentrations in their active state. The high sensitivity of SERS has allowed us to detect molecular interactions between the ligand-binding domain of LasR (LasRLBD) as a soluble apoprotein and modulators of *P. aeruginosa* QS. We found that QS activators and inhibitors produce differential SERS fingerprints in LasRLBD, and in combination with molecular docking analysis provide insight into the relevant interaction mechanism. This study reveals signal-specific structural changes in LasR upon ligand binding, thereby confirming the applicability of SERS to analyze ligand-induced conformational changes in proteins.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Biosurfaces Lab led by Ralf Richter, together with researchers from Cambridge and Grenoble, has demonstrated how 'superselective' binding of probes to a surface can be tuned. This work could lay the foundation for the rational design of a new generation of analytical, diagnostic and therapeutic probes in biomedical applications.

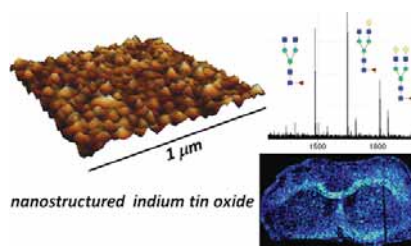


### Designing Multivalent Probes for Tunable Superselective Targeting

Dubacheva, G. V.; Curk, T.; Auzély-Velty, R.; Frenkel, D.; Richter, R. P.  
*P. Natl. Acad. Sci. USA* **2015**, 201500622.

Targeting in biomedicine typically relies on the specific binding of a 'ligand' on a tailor-made nanoprobe to a 'receptor' on the desired cell/tissue. Conventional probes efficiently distinguish a biological entity displaying the receptor from others that do not, but exhibit limited selectivity when the entities to be distinguished display a given receptor at different densities. Multivalent probes that bind several receptors simultaneously potentially can sharply discriminate between different receptor densities. Through a combination of synthetic chemistry, experiments with well-defined model systems, analytical modelling and numerical simulations of multivalent polymers, the authors demonstrate how such 'superselective' binding can be tuned to target a desired receptor density. The obtained results provide quantitative predictions of how probe characteristics such as size, valency and affinity affect binding selectivity, and hence facilitates the design of effective multivalent probes.

The Glycotechnology laboratory led by Niels-Christian Reichardt in collaboration with Luis Yate, manager of the Surface Fabrication and Analysis Platform and the Radiochemistry laboratory headed by Jordi Llop reported on a new material for the imaging of tissue samples and for the general matrix-free analysis of small molecules by surface assisted mass spectrometry



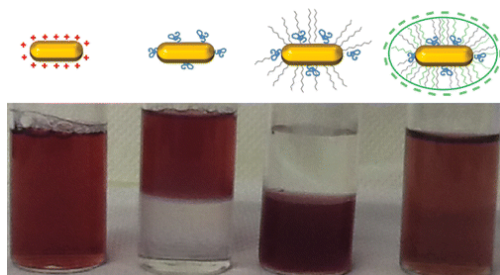
### Nanostructured ITO slides for Small Molecule Profiling and Imaging Mass Spectrometry of Metabolites and by Surface-Assisted Laser Desorption Ionization MS

López de Laorden, C.; Beloqui, A.; Yate, L.; Calvo, J.; Puigivila, M.; Llop, J.; Reichardt, N.-C.  
*Anal. Chem.* **2015**, 87, 431–440

By carefully adjusting the sputtering conditions the CIC biomaGUNE researchers were able to prepare indium tin oxide (ITO) thin films as a substitute for the weak organic acids commonly used in MALDI-TOF spectrometry. The new material retains the high transparency of ITO films and is fully compatible with traditional histology by light microscopy, Imaging Mass Spectrometry of proteins and matrix-free imaging of small molecules, drugs and metabolites. Furthermore, ITO slides can be readily functionalized with biomolecules like carbohydrates, proteins or nucleic acids, opening up new exciting opportunities for the development of high-throughput mass spectrometry based bio-analytical assays for use e.g. in food and biopharmaceutical quality control. Currently, research is under way in collaboration with the Basque technology corporations Tecnalia and IK4, to study new applications and the large scale production of the new material.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Bioengineered Particles Lab led by Wolfgang Parak, in collaboration with the Philipps-University of Marburg, reports on a method to generate noble metal nanoparticles (NPs) with polymer coatings for biological applications



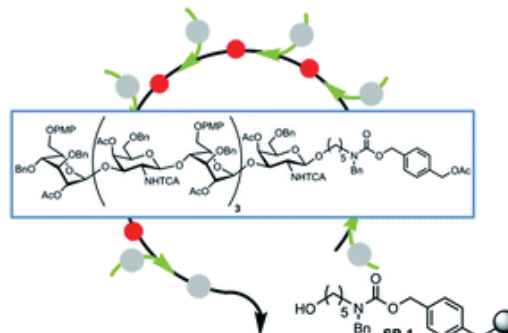
### Phase Transfer and Polymer Coating Methods toward Improving the Stability of Metallic Nanoparticles for Biological Applications

Soliman, M. G.; Pelaz, B.; Parak, W. J.; del Pino, P.

*Chem. Mat.* **2015**, *27*, 990–997

This paper describes a general method to generate noble metal nanoparticles with polymer coatings. One of the widely used approaches to stabilize nanoparticles in aqueous solution involves wrapping with amphiphilic polymers. This methodology has been extensively employed for polymer coating of small hydrophobic nanoparticles (diameter of inorganic core < 20 nm), thereby enabling phase transfer from an organic solvent to aqueous solution. The polymer coating approach is herein extended to nanoparticles originally synthesized in aqueous solution by a two-step method. First, nanoparticles are subjected to aqueous-to-organic phase transfer. The phase transfer protocol is demonstrated for particles made of different materials (Au and Ag), sizes (up to 100 nm), and shapes (spheres, rods, and flat-triangular prisms). Second, nanoparticles are coated with an amphiphilic polymer. The colloidal stability of a variety of the newly designed nanoparticles is assayed against different media of biological relevance. In preliminary cellular studies, the biocompatibility of polymer coated Au nanoparticles is investigated in different cell lines.

The Glycotechnology laboratory led by Niels Reichardt has reported a high yield solid-phase assembly of monosaccharide building blocks into advanced oligosaccharide precursors up to the size of an octasaccharide for two important classes of glycosaminoglycans



### Solid-Phase Assembly of Glycosaminoglycan Oligosaccharide Precursors

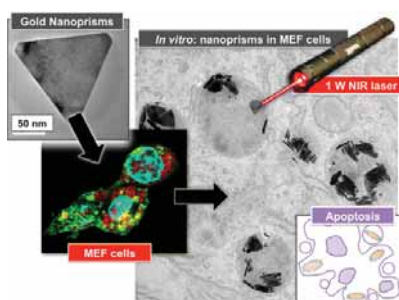
Guedes, N.; Kopitzki, S.; Echeverria, B.; Pazos, R.; Elosegui, E.; Calvo, J.; Reichardt, N.-C.

*RSC Adv.* **2015**, *5*, 9325–9327.

Many glycosaminoglycans are key biological response modifiers that can engage in selective interactions with growth factors, cytokines and enzymes. Tapping into the therapeutic potential of GAG-based drugs is seriously hindered by a lack of knowledge on the binding specificities of protein targets. In this regard, the availability of the probes required for binding and functional studies will greatly benefit from the development of streamlined and more efficient procedures for their chemical synthesis. Solid-phase synthesis with its potential for substantial savings in synthesis time and cost through automation should be particularly well suited for the synthesis of these large heterogeneous linear oligomers but its development has considerably lagged behind developments in solution-phase synthesis of these oligomers. The reported strategy is an important step towards the solid-phase assisted preparation of large synthetic compound libraries for biomedical studies of glycosaminoglycans.

## SCIENTIFIC OUTPUT – RESEARCH HIGHLIGHTS

The Bioengineered particles Lab led by Wolfgang Parak Lab, in collaboration with the group of Jesús M. de la Fuente and the group of Julián Pardo, reports on intracellular signaling cascades involved in the apoptotic response to photothermal therapy using cells harboring photothermal transducing gold nanoprisms



### Dissecting the Molecular Mechanism of Apoptosis during Photothermal Therapy Using Gold Nanoprisms

Perez-Hernandez, M.; del Pino, P.; Mitchell, S. G.; Moros, M.; Stepien, G.; Pelaz, B.; Parak, W. J.; Galvez, E. M.; Pardo, J.; de la Fuente, J. M.

*ACS Nano* **2015**, *9*, 52–61

The photothermal response of plasmonic nanomaterials can be exploited for several biomedical applications in diagnostics and therapy. The most common cellular response to photothermal cancer treatment using plasmonic nanomaterials is necrosis. Here we report the use of laser-induced photothermal therapy employing gold nanoprisms to specifically induce apoptosis in mouse embryonic fibroblast cells transformed with the SV40 virus. Laser-irradiated "hot" nanoprisms activate the intrinsic/mitochondrial pathway of apoptosis, which is mediated by the nuclear-encoded proteins Bak and Bax through the activation of the BH3-only protein Bid. We confirm that an apoptosis mechanism is responsible by showing how the nanoprism-mediated cell death is dependent on the presence of caspase-9 and caspase-3 proteins. The ability to selectively induce apoptotic cell death and to understand the subsequent mechanisms provides the foundations to predict and optimize NP-based photothermal therapy to treat cancer patients suffering from chemo- and radioresistance.

A computational study performed by Luca Salassa (in collaboration with the Casini group, University of Groningen) highlights the influence of the gold oxidation state in the structure of "Gold Fingers"



### Gold Finger Formation Studied by High-Resolution Mass Spectrometry and in Silico Methods

Laskay, U. A.; Garino, C.; Tsybin, Y. O.; Salassa, L.; Casini, A.

*Chem. Commun.* **2015**, *51*, 1612–1615.

High-resolution mass spectrometry and quantum mechanics/molecular mechanics studies were employed for characterizing the formation of two gold finger (GF) domains from the reaction of zinc fingers (ZF) with gold complexes. The influence of both the gold oxidation state and the ZF coordination sphere in GF formation provided useful insights into the possible design of new gold anticancer agents targeting specific Zinc Finger motifs.

# TRAINING ACTIVITIES

## Training Activities

The training activities of CIC biomaGUNE during 2015 can be summarized as follows: 24 seminars, received 59 research internships, organized more than 40 guided tours and two scientific workshops.

### SEMINARS

CIC biomaGUNE runs a strong annual program of scientific seminars, which are delivered by internationally recognized local and foreign researchers, which contributes to the permanent education of its researchers and the scientific community. During 2015, **24** seminars were delivered.

**15/01/2015**

Plasmonic Nanostructure: Identification, Detection and Killing of Escherichia Coli

**Prof. Sabine Szunerits** - LILLE 1 University, France

**28/01/2015**

Benefits from Electronic Structure Computing. A Case Study: Modeling of Electron Transfer triggered by Quantum Dot Photoactivation.

**Prof. Jesús Ugalde** - EHU-UPV

**04/03/2015**

Colouring Atoms in Three Dimensions.

**Prof. Sara Bals** - University of Antwerpen, Belgium

**06/03/2015**

Magnetic Nanoparticles: A precision tool for cell imaging and activations

**Prof. Jinwoo Cheon** - Yonsei University, Korea

**16/03/2015**

Recent Topics in Nanotechnology: Gold Atom (Crown Jewel) Catalysts and Hybrid Organic Thermoelectric Films

**Prof. Naoki Toshima** - Tokyo University of Science Yamaguchi, Japan

**13/04/2015**

Protein-based functional nanostructures and multifunctional nanoparticles

**Aitziber L. Cortajarena** - IMDEA Nanociencia

**16/04/2015**

Attractive iron oxide nanoparticles for clinical applications

**Dr. Anna Roig** - ICMAB-CSIC

**17/04/2015**

Directed Self-Assembly of Janus Nanoparticles for SERS Applications

**Denis Rodriguez-Fernández** - CIC biomaGUNE

**27/05/2015**

The significance of glycosylation to the biopharmaceutical industry

**Dr. Richard Easton** - SGS Life Sciences, UK

## TRAINING ACTIVITIES

**29/05/2015**

Sophisticated nanopatterned metal networks for transparent flexible electrodes and optoelectronic applications

**Michael Giersig** - Freie University Berlin, Germany

**29/05/2015**

Colloidally Stable, Water Soluble, Biocompatible, Semiconductor Nanocrystals with a Small Hydrodynamic Diameter

**Paul Mulvaney** - University of Melbourne, Australia

**15/06/2015**

Programmable Atom Equivalents from Nucleic Acid-Modified Nanoparticle Constructs

**Prof. Chad A. Mirkin** - Northwestern University, USA

**25/06/2015**

Twisted Polycyclic Aromatic Hydrocarbons with Pyrazine Rings: From Molecular to Low-dimensional Materials

**Prof. Aurelio Mateo-Alonso** - Polymat, UPV/EHU

**08/07/2015**

Chemicals and Materials from Biomass

**Dr. Jalel Labidi** – Departamento de Ingeniería Química y del Medio Ambiente, UPV/EHU

**14/07/2015**

Mediating plasmonic signature of metal nanostructures within polymer matrices

**Dr. Vladimir V. Tsukruk** – Georgia Institute of Technology, Atlanta, USA

**15/07/2015**

Site-specific glycoproteome analysis for biomarkers in autoimmune diseases

**Dr. Carlito B. Lebrilla** – University of California, Davis, USA

**11/09/2015**

Plasmonic Metal Oxide Nanocrystals

**Dr. Delia J. Milliron** – McKetta Department of Chemical Engineering, The University of Texas at Austin

**21/09/2015**

Charge regulation of hydrogels through pH and ionic strength: Implications for protein adsorption

**Dr. Igal Szleifer** – Northwestern University, Evanston, USA

**24/09/2015**

Atomic force microscopy: What we can learn from prodding biomolecules

**Dr. Bart Hoogenboom** – London Centre for Nanotechnology, London, UK

**08/10/2015**

Protein control of soft and hard matter

**Dr. Tobias Weidner** – Max-Planck-Institute for Polymer Research, Mainz, Germany



## TRAINING ACTIVITIES

**15/10/2015**

Modular Multimodal Iron Oxide-Based Nanocarriers for Image-Guided dsRNA Immunostimulation and Platinum Anticancer Drug Design

**Beatriz Macarena Cobaleda** – Theranostic Nanomedicine Laboratory, CIC biomaGUNE

**29/10/2015**

Material-cell interactions: From TiO<sub>2</sub> nanoparticles to conducting polymers

**Prof. Christine Payne** – School of Chemistry and Biochemistry, Georgia Tech, Atlanta, USA

**03/11/2015**

Exploring new labelling strategies for boronated compounds: towards fast development and efficient assessment of BNCT drug candidates

**Kiran Babu Gona** – Radiochemistry-Nuclear Imaging Laboratory, CIC biomaGUNE

**17/12/2015**

Christmas Lecture: Deciphering the secrets of Imsety

**Dr. Malu Martínez Chantar** –CIC bioGUNE

## SCIENTIFIC WORKSHOPS/CONFERENCES/EVENTS

### BIOMAPP

The 1<sup>st</sup> Young Researchers Workshop on Biomaterials and Applications (bioMAPP15), organized by CIC biomaGUNE's Research Associates, took place the 19<sup>th</sup> and 20<sup>th</sup> of October 2015 in CIC biomaGUNE. The meeting focused on the fields of biomaterials and their applications in imaging, therapy and sensing. The goal was to create an environment for young scholars to present their research and gain experience in academic conferencing, for networking and exchange of ideas. The workshop was attended by 44 young researchers. During two days, 3 prominent scientists delivered plenary talks and selected researchers provided 20 contributed talks and 21 poster presentations.



## TRAINING ACTIVITIES

### INTERNATIONAL WORKSHOP IN MOLECULAR IMAGING

The International Workshop in Molecular Imaging was held from the 10<sup>th</sup> to the 12<sup>th</sup> of November 2015 in CIC biomaGUNE. The Workshop attracted world experts as speakers in the fields of Magnetic Resonance Imaging, Nuclear Imaging and Radiochemistry/Radiopharmacy. The three-day event covered fundamentals, state-of-the-art technological aspects and the most recent advances in the broad field of preclinical and clinical molecular imaging. Keynote lectures were complemented with poster sessions and flash presentations to promote fruitful interactions between world leaders and young emerging scientists. Importantly, coffee breaks and social events enabled informal discussions between invited speakers and all participants in a friendly environment in the beautiful city of San Sebastian. The event attracted over 102 researchers from different countries including Portugal, Holland, Germany, Hungary, France, Italy, UK, USA and Spain.



### CIC BIOMAGUNE'S INTERNATIONAL SCIENTIFIC ADVISORY BOARD (ISAB) VISIT

The ISAB visited CIC biomaGUNE the 17<sup>th</sup> and 18<sup>th</sup> of September 2015 to evaluate the progress of the Centre since 2012.



# TRAINING ACTIVITIES

## PHD PROGRAMMES

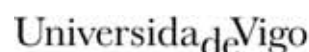
In partnership with the **University of the Basque Country (UPV/EHU)**, CIC biomaGUNE participates in the following PhD programmes:

- PhD in Synthetic and Industrial Chemistry
- PhD in Applied Chemistry and Polymeric Materials
- PhD in Molecular Biology and Biomedicine
- PhD in Medicine and Surgery



Also in partnership with the **University of Vigo (UVIGO)**, CIC biomaGUNE participates in the following PhD programme:

- PhD in Colloid and Interface Science and Technology



## INTERNATIONAL GRADUATE SCHOOL PROGRAMMES

Since 2011 **CIC biomaGUNE** and **CIC bioGUNE** together with the **University of Liverpool (UoL)** run the International joint graduate school program, aimed at implementing 4-year joint PhD degrees.

The objective of the joint PhD program is to provide PhD students with top quality multidisciplinary training at the interface between the fields of biology, chemistry, nanobiotechnology and materials science. The students benefit from an international training and are exposed to different research areas. The joint training of PhD candidates fosters closer ties and cooperation between research groups and researchers of both CICs and the UoL.



The following PhD projects are currently running:

- **Chemical biology tools for structure-function studies on heparan sulfates: decoding specificity in fgf signalling.** The project is jointly supervised by Dr. Niels Reichardt (CIC biomaGUNE) and Prof. Jerry Turnbull (UoL).
- **Development of Plasmonic Hybrid Nano-Systems for Biodetection.** The project is jointly supervised by Prof. Luis Liz-Marzán (CIC biomaGUNE) and Prof. Mathias Brust (UoL).
- **Supramolecular structure and dynamics of extracellular matrix.** The project is jointly supervised by Dr. Ralf Richter (CIC biomaGUNE) and Prof. Dave Fernig and Dr. Ed Yates (UoL).

# TRAINING ACTIVITIES

## UNDERGRADUATE STUDENT PROGRAM

In partnership with the **University of the Basque Country (UPV/EHU)**, CIC biomaGUNE is actively participating in the following MSc courses by providing lectures and direction of master thesis:

- Master in Molecular Biology and Biomedicine
- Master in Nanoscience
- Master in Chemistry and Polymers



## VOCATIONAL TRAINING PROGRAM

CIC biomaGUNE has agreements with **CPES CESA BHIP** and **Don Bosco**, Centres for Intermediate and Superior level vocational training in the fields of Chemistry or Biosciences to host training internships of students. Every year several training placements take place at different laboratories of the Centre. The undergraduates are mentored and supervised by PhD students or a postdoctoral researchers and receive hands-on-training.



## RESEARCH INTERNSHIPS

	2012	2013	2014	2015
Research stays from CIC biomaGUNE	n/d	14	47	30
Research stays to CIC biomaGUNE	31	45	67	59

# OUTREACH

## Outreach

CIC biomaGUNE regularly receives visits from high-school and university students who come to the Centre to have a closer look at our activity. Visits typically include a lecture about biomaterials and/or nuclear imaging in the context of life sciences, an open discussion with researchers of the Centre, and a guided visit to the laboratories and facilities including the Molecular Imaging Platform.

	2013	2014	2015	N. Participants/ Impact
Bachelor students visits	2	2	2	150
Undergraduate student program	1	2	2	125
Talks in schools	1		3	50
Vocational Training program	1	3	4	8
Guided visits at MIP	53	40	15	110
Pint of Science			1	450
CIC Network Journal	2		1	1500

- February 2015. **Visit from High School from Portugal** (Penacova-Coimbra). Hosted by Eunice Sofia Da Silva and Sameer Manohar Joshi, PhD students of the Radiochemistry and Nuclear Imaging Group.
- February 2015. Niels Reichardt, Principal Investigator of the Glycotechnology group **interviewed at "La Mecanica del Caracol" from Eitb Radio (Basque Country's Radio)**. Dr. Reichardt talks about the new Marie Skłodowska-Curie projects funded by the European and led by CIC biomaGUNE, which will serve to train new researchers in the fields of glycosciences, immunology and and the development of hybrid materials for controlled drug release.
- March 2015. **Visit from UPV-EHU 4th year biochemistry degree students** with Prof. Félix Goñi. Host: Daniel Padró. Presentation from Mónica Carril and visit of the Molecular Imaging Facility.
- March 2015. **Visit from SUMMA Aldapeta high school students**. Visit of the Molecular Imaging Unit and the Technological platforms.
- March 2015. CIC biomaGUNE is present at **Imaginenano 2015**, one of the largest European Events in Nanoscience & Nanotechnology, one of the largest European Events in Nanoscience & Nanotechnology, held in Bilbao from the 10<sup>th</sup> to 13<sup>th</sup> March 2015. The event gathered 6 conferences covering almost of the aspects of nanotechnology and nanosciences and an industrial exhibition.
- April 2015. **Talk at school** (CEPS Castroverde, Lugo) by Prof. Liz-Marzán "Jugando a cambiar de escala" and "Nanotecnología para el mundo contemporáneo".
- May 2015. CIC biomaGUNE participated at **Pint of Science-Donostia 2015**, an international science festival that brings science to pubs. In the frame of the International Year of Light, Prof. Luis Liz-Marzán,

# OUTREACH

Scientific Director of CIC biomaGUNE together with Dr. Javier Aizpurua from the Materials Physics Centre (CSIC - UPV/EHU and DIPC) discussed about new optical phenomena in nanomaterials and their application in various fields of our life.

- May 2015. **Visit from UVIGO students** from department of applied physics.
- October 2015. **Talk at school (IES Cala de Mijas, Málaga)** by Prof. Liz-Marzán “Jugando con la luz en la nanoescala (colores a la carta)”.
- November 2015. **Talk at school (IES La Salle, Beasain)** by Prof. Liz-Marzán “Jugando con la luz en la nanoescala (colores a la carta)”.
- November 2015. Markel Olano, **Head of the Council of Gipuzkoa** and Ainhoa Aizpuru, Deputy of Economic Development, Rural and Territorial Balance, **visit** CIC biomaGUNE. During the visit, CIC biomaGUNE's General Director, José M Mato, and the Centre's Scientific Director, Luis Liz Marzán, led a tour of the Centre and Molecular Imaging Facility.
- December 2015. Fernando López Gallego, Ikerbasque Fellow at CIC biomaGUNE, speaks about his research at **CIC Network**.
- January-December 2015. More than 40 guided tours to CIC biomaGUNE's facilities including the Molecular Imaging Facilities were given to all invited speakers from the CIC biomaGUNE seminars programme.

## PINT OF SCIENCE

In 2015, Dr. Fernando López Gallego and Dr. Marek Grzelczak, Ikerbasque Research Fellows at CIC biomaGUNE organized the "Donostia-Pint of Science" event, which was held for the first time in Spain. This initiative brings Science to local bars, thereby breaking down the barriers that separate science from society. The event was a great success, not only because of the high degree of participation, but also because of the high interest shown by the public, who applauded the effort of bringing science closer to the public.



## CÁPSULAS DE NANOTECNOLOGÍA

Contribution to the audiovisual project “Cápsulas de Nanotecnología” from the SAMCA Chair of the University of Zaragoza for the dissemination and promotion of research in Nanoscience and Nanotechnology. In particular the BioNanoPlasmonics Laboratory participated on the Nanophotonics chapter: <https://youtu.be/xDEj5UUjUx4>



## OUTREACH

### FÁBRICA DE IDEAS

Joint contribution of CIC biomaGUNE and CIC bioGUNE to the National TV program “Fábrica de Ideas” on the 'Innova' section, where the program visits a business or innovation Centre.



### CIC NETWORK

Within outreach activities, CIC biomaGUNE is involved in the production of the CIC NETWORK magazine, the science magazine of the Cooperative Research Centres. To date 15 issues have been published, the most recent one in March 2015.



### MEDIA

CIC biomaGUNE is additionally committed to disseminating research results not only to the scientific community but also to the general public. Such efforts are reflected in the table below.

	2013	2014	2015
Impacts in General Media	21	14	82
Impacts in Institutional Media	4	8	3
Impacts Information Websites	30	45	75

# OUTREACH

Highlighted media appearances:

Date	Headline	Impacts N°
12/02/2015	TV3 telethon funds Alzheimer's disease study by CIC bioGUNE and CIC biomaGUNE	5
16/02/2015	Europe entrusts CIC biomaGUNE with the leadership of "Marie Curie" projects to train new scientists	3
07/05/2015	The scientific director of CIC biomaGUNE, Luis Liz-Marzán, elected member of the Royal Academy of Sciences	17
15/05/2015	A study of CIC biomaGUNE opens the possibility of designing a new generation of nanomaterials that act as probes able to better distinguish different types of cells	11
17/09/2015	CIC biomaGUNE's International Scientific Advisory Board (ISAB) visits CIC biomaGUNE to review and evaluate the progress of the conducted research	4
02/10/2015	Luis Liz-Marzán awarded with the 2015 Rey Jaime I Award in Basic Research.	48
19/10/2015	CIC biomaGUNE organizes the 1st Young Researchers Workshop on Biomaterials and Bioapplications (bioMAPP 15)	6
23/10/2015	CIC biomaGUNE and CNIC team up to become an international reference in biomedical imaging	17
09/11/2015	CIC biomaGUNE organizes the first International Workshop in Molecular Imaging in San Sebastian	6
01/12/2015	Prof. Maurizio Prato, one of the world's leading experts in graphene and carbon nanotubes joins CIC biomaGUNE	6

The Twitter and LinkedIn presence has remained, with an increase of the number of followers/connections to more than 450.

Twitter account (@CICbiomaGUNE): <https://twitter.com/CICbiomaGUNE>

	January 2015	December 2015
Followers	31	451
Profile visits	273	6071
Tweet Impressions	6367	61256
Mentions	32	287



# OUTREACH

21/04/2015

CIC biomaGUNE, CIC bioGUNE and the 'bio'cluster of companies, Basque Biocluster, organized a workshop to explore areas of cooperation and seek closer partnerships.

Centros de investigación y empresas 'bio' de Euskadi buscan estrechar lazos de colaboración

26 de abril, 2015

Los centros de investigación cooperativa CIC bioGUNE y CIC biomaGUNE, y la asociación de empresas del sector de las biotecnologías en Euskadi, Basque Biocluster, han organizado una jornada de trabajo con el objetivo de impulsar la cooperación entre el tejido empresarial y la actividad científica.

El evento, que se celebró el pasado 21 de abril, tuvo el objetivo de incentivar la promoción de la colaboración entre empresas y los centros de investigación (CIC bioGUNE) y CIC biomaGUNE mediante la puesta en común de las actividades o áreas de trabajo que se desarrollan en la actualidad.



## Liz Marzán, nombrado miembro de la Real Academia de Ciencias

El director científico del CIC biomaGUNE es el tercer investigador más que se incorpora a esta organización estatal

04/05/2015 - 11:38 (GMT)



Artículo en: RAC, News Academia, País Vasco, España, Investigación científica, Cultura, Ciencia

El investigador bioquímico y director científico del centro de investigación cooperativa CIC biomaGUNE, Luis Manuel Liz Marzán, se ha incorporado como académico correspondiente a la Real Academia de Ciencias Exactas, Físicas y Naturales de España.

07/05/2015

The Scientific Director of CIC biomaGUNE, Luis Liz-Marzán, elected member of the Royal Academy of Sciences.

15/05/2015

A study of CIC biomaGUNE opens the possibility of designing a new generation of nanomaterials that act as probes able to better distinguish different types of cells.

## Un estudio abre la puerta al diseño de nanomateriales superselectivos que permitan avanzar en el diagnóstico del cáncer

Nota esta noticia

Comparte: Facebook, Twitter, LinkedIn, YouTube



La investigación, liderada por el científico Raffi Richter, abre la puerta al diseño de nanomateriales que funcionan como sondas que permitan distinguir los diferentes tipos de células a partir de los receptores de la superficie celular.

Un estudio liderado por el Centro de Investigación Cooperativa en Biomateriales CIC biomaGUNE, con sede en Donostia, ha concluido que la identificación de células y tejidos que permitan realizar diagnósticos y desarrollar terapias para enfermedades como el cáncer puede ser más eficiente mediante el diseño de una nueva generación de nanomateriales superselectivos.

# OUTREACH



18/05/2015

Luis Liz Marzán Scientific Director of CIC biomaGUNE interviewed at Diario Vasco: "being at the frontiers of Science requires a high investment".

02/06/2015

Luis Liz-Marzán, scientific director of CIC biomaGUNE awarded with the 2015 Rey Jaime I Award in Basic Research.

## Los premios Jaime I reconocen a la AECC, Liz-Marzán, Dolado, Peñuelas y Artal

Están dotados con 100.000 euros en cada una de sus modalidades y tiene un parido en el que han formado parte 21 premios Nobel

Comunidad Valenciana | 02/06/2015 - 12:34 | Última actualización: 02/06/2015 - 12:34



Foto de familia de los galardonados de los reconocimientos Premios Rey Jaime I entre otros señores premios Nobel, que comenzan las felicitaciones para recibir los galardones de esta edición y presentar una declaración institucional en favor del tecnológico I+D+i en Valencia

## «El camino científico es tan largo que puede ser infinito»

Cuatro investigadores de Ikerbasque tienen ahora un año para demostrar su valía y cumplir su sueño de ser líderes. Han conseguido algo parecido a la estabilidad en CIC biomaGUNE, pero no es a cambio de nada.



La idea de Javier Requena: traslada de la investigación médica con la biotecnología en genómica para aplicar a cultivos agrícolas. 'Una revolución por el grupo de genómica de la RIA de Sociedad Española de Física y Química. 'Se trata de un año para la cual recibirá los premios, a nivel

01/06/2015

Interview to CIC biomaGUNE Ikerbasque Fellows Marek Grzelczak, Mónica Carril, Fernando López and Javier Reguera.

31/08/2015

Interview to Prof. Manuel Martín-Lomas, CIC biomaGUNE Scientific Director from 2006 to end of 2012, and Prof. Soledad Penadés, Principal Investigator of the Glyconanoparticles laboratory from 2006 until February 2015.



## Vidas a la luz de la ciencia

Subieron al Norte para crear Biomagune. Hubo quien les llamó 'locos'

Los investigadores Manuel Martín Lomas, Soledad Penadés, Fernando López y Javier Reguera. Ahora a la genómica

Ellos son los protagonistas. Han pasado años desde que se fundó el centro de Ikerbasque, pero en sus comienzos ya había un espíritu de colaboración y trabajo en equipo. Ellos son los protagonistas. Han pasado años desde que se fundó el centro de Ikerbasque, pero en sus comienzos ya había un espíritu de colaboración y trabajo en equipo. Ellos son los protagonistas. Han pasado años desde que se fundó el centro de Ikerbasque, pero en sus comienzos ya había un espíritu de colaboración y trabajo en equipo.

# OUTREACH

15/09/2015 09:03

## El Comité Científico Internacional visita CIC biomaGUNE para evaluar su producción científica

Bilbao, Europa Press El Centro de Investigación Cooperativa en Biomateriales CIC biomaGUNE recibe este jueves y viernes a su Comité Científico Asesor Internacional, con el objetivo de analizar la producción científica desarrollada por la entidad y trazar las líneas de trabajo para el futuro.

Integrado por investigadores de "elevado prestigio internacional" en el ámbito de los nanobiomateriales y la imagen molecular, el Comité se reúne cada tres años en la sede de CIC biomaGUNE, ubicada en el Parque Tecnológico de San Sebastián, según ha informado CIC biomaGUNE.

17/09/2015

CIC biomaGUNE's International Scientific Advisory Board (ISAB) visits CIC biomaGUNE to review and evaluate the progress of the conducted research.

23/10/2015

CIC biomaGUNE and CNIC team up to become an international reference in biomedical imaging.

## Biomagune y CNIC se alían para convertirse en una referencia internacional en imagen biomédica



El consorcio pretende ofrecer a la comunidad científica una infraestructura única

## Biomagune acoge en San Sebastián el congreso internacional de imagen biomédica

Uno de los objetivos del evento es impulsar la interacción entre dedicados expertos internacionales y jóvenes investigadores

2. Europa Press

El Centro de Investigación Cooperativa en Biomateriales, Biomagune, organiza Molecular Imaging 2015, un congreso internacional de tres días especializado en imagen molecular que permite para reunir en San Sebastián a los expertos internacionales más destacados en disciplinas como la radiofarmacia, la resonancia magnética y la imagen nuclear. El evento tiene lugar entre este martes y el jueves en la sede del centro de investigación, ubicada en el Parque Tecnológico de San Sebastián, y tiene el objetivo de reunir los últimos avances tecnológicos y las técnicas más avanzadas en imagen molecular clínica y preclínica. Las jornadas están integradas por un variado programa de conferencias.



06/11/2015

CIC biomaGUNE hosts the international congress of biomedical imaging.

01/12/2015

Prof. Maurizio Prato, one of the world's leading experts in graphene and carbon nanomaterials, joins CIC biomaGUNE.

## Biomagune incorpora a uno de los mayores expertos del mundo en grafeno

Se trata del científico italiano Maurizio Prato, quien liderará una nueva línea de investigación para buscar aplicaciones de estos materiales en el ámbito de la neurociencia y las lesiones medulares

2. Europa Press

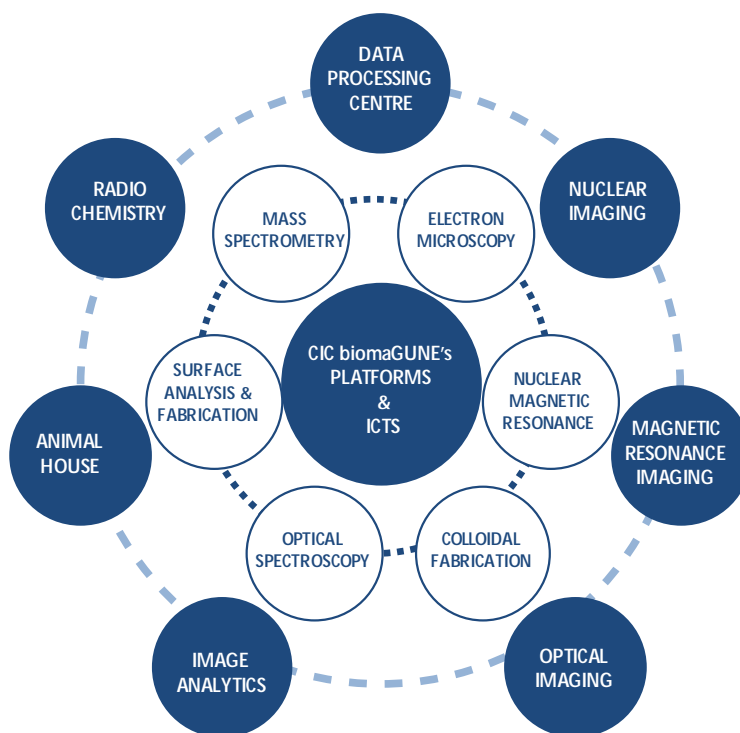
El Centro de Investigación Biomagune de San Sebastián ha incorporado a uno de los mayores expertos del mundo en materiales como el grafeno y los nanotubos de carbono, el científico italiano Maurizio Prato. Según ha informado hoy en un comunicado este centro de investigación en Biomateriales, el investigador, que reside en Biomagune a través del grupo que dirige, liderará una nueva línea de investigación para buscar aplicaciones de estos materiales en el ámbito de la neurociencia y las lesiones medulares. De esta manera, Maurizio Prato trabajará con "nanotubos de carbono".



# RESEARCH FACILITIES

## Research Facilities

CIC biomaGUNE's state-of-the art facilities are depicted in the diagram below. The outer ring facilities are related to the Molecular Imaging Unit (ICTS) while the inner ring facilities refer to CIC biomaGUNE's Technological Platforms.



# RESEARCH FACILITIES

## NEW EQUIPMENT

Thanks to the support received by the Basque Government and the Council of Gipuzkoa it has been possible to acquire an **Inductively Coupled Plasma Mass Spectrometry (ICP-MS)** to support CIC biomaGUNE's scientific activities.

## ANIMAL FACILITY



On June 18, 2015 CIC biomaGUNE received full **accreditation** from the **Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC)**.

The AAALAC full accreditation demonstrates CIC biomaGUNE's determination and ability to provide and maintain a high quality programme of laboratory animal care and use throughout the R&D activity. CIC biomaGUNE is one of only seven organizations in Spain accredited by AAALAC, putting the Centre in a privileged position to participate in international research projects and collaborations with pharmaceutical and biotech companies, for which this accreditation is highly valued. AAALAC international is a private, nonprofit organization that enhances the quality of research, teaching, and testing by promoting human, responsible animal care and use through voluntary accreditation and assessment programs.

During 2013 the management of the Animal Facility management has been externalized and the services have been subcontracted to the specialized firm Charles River.

## MOLECULAR IMAGING FACILITY

In October 2015, CIC biomaGUNE and CNIC signed an agreement for the joint management of part of its imaging facilities. With this agreement, the Network "**Red Distribuida de Imagen Biomédica (ReDIB)**" has been founded within the ICTS framework "Unique technical scientific infrastructure" promoted by the Spanish Ministry of Economy and Competitiveness.

The agreement will allow external access of scientists to the advanced imaging facilities of the two Centres, as well as the exchange of researchers between the two institutions and the development of a joint excellence scientific training plan.

[www.cicbiomagune.es](http://www.cicbiomagune.es)

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