International conference on nanomedicine, cancer therapy, safety assessment & sustainability

Strasbourg, France, **Wednesday 16th & Thursday 17th September 2026**

Venue: Collège Doctoral Européen, 46 boulevard de la Victoire, Strasbourg

DAY 1 – Wednesday 16th September

Time	Talk	First Name	Last name	Talk title	Chairman/Chairwoman
13:30 14:00	Registration				
14:00 14:10		Cécilia	Ménard-Moyon	Welcome and introduction	
14:10 14:45	1	**Invited** Alberto	**speaker** Bianco	Synthesis, properties and biomedical applications of carbon dots	Florence Gazeau
14:45 15:00	2	Chiara	Puccinelli	One-Pot Graphitic Encapsulation of Fe_7C_3 Nanoparticles for Enhanced Photothermal Cancer Therapy	
15:00 15:15	3	Veronika	Borggraefe	Molecularly imprinted polymer (MIP) nanogels for biomedical applications	
15:15 15:30	4	Lorenzo	Riccio	Thermoresponsive p(NIPAM-co-NIPMAM)-Iron Oxide Hydrogels Composite for Localized Antimicrobial and Cancer Therapies	
15:30 15:45	5	Ayush	Shukla	Societal and Ethical Aspects of Cancer R&D: Imagining Therapeutic Futures	
15:45 16:15	Coffee break				
16:15 16:50	6	**Invited** Daina	**speaker** Romeo	Good for patients and the planet: the role of LCA in the pharmaceutical sector	Davide Bonifazi
16:50 17:05	7	Erica	Frostegård	Synthesis of IONC@PDA-Cu^{2+} for Photothermal and Chemodynamic Therapy	

17:05 17:20	8	Andreas	Reisch	Gold in Plastic: Polymeric Nanoparticles for SWIR Bioimaging
17:20 17:35	9	Wilder	Ruiz	From RNA-seq Toxicogenomics to a Deployed AI-Assisted Research Platform
17:35 17:50	10	Laraib	Kiran	Towards gold nanoparticle coating: design and synthesis of a functional trivalent organic platform
17:50 18:05	11	Daniel	Rieger	Development of a perfused melanoma-on-a-chip model to evaluate efficacy and toxicity of a CAR T-cell therapy
18:05 19:00	Poster session & cocktail dinner			
19:00	End of the first day			

DAY 2 – Thursday 17th September

Time	Talk	First Name	Last name	Talk title	Chairman/Chairwoman
9:00 9:35	12	**Invited** Amaia	**speaker** Cipitria	Injectable and viscoelastic click alginate hydrogels for spatio-temporal T-cell administration in vivo	Else Marit Inderberg
9:35 9:50	13	Jacopo	Sorani	From Laboratory Protocols to Scale-Up: Two Digital Tools for Prospective LCA of Fine Chemicals, Pharmaceuticals and Nanomaterial	
9:50 10:05	14	Maria Julien	Loustau Caumartin	*Title to be confirmed*	
10:05 10:20	15	Amalie	Leinebo	Nanohyperthermia and CAR-T combination therapy for melanoma: An *in vitro* screening workflow	
10:20 10:35	16	Shayamita	Ghosh	Iron oxide nanoparticle driven hyperthermia for tumor Extracellular Matrix Remodeling in Metastatic Melanoma	
10:35 11:05	Coffee break				
11:05 11:40	17	**Invited** Iseult	**speaker** Lynch	Biomolecular coronas as a mechanistic link between nanoparticle design, biological identity and safe-by-design nanomedicine	Roland Hischier
11:40 11:55	18	Tatiana	Bobrova	HLA-G–targeting CAR T cells in melanoma: Role of IFNγ signaling in tumour cell sensitivity and resistance mechanisms	
11:55 12:10	19	Stéphane	Roux	Gold-based nanostructures designed for image-guided therapy	
12:10 12:25	20	Thibault	Leray	A novel highly melanoma-specific TCR-T cell product demonstrates safe and enhanced responses against melanoma solid tumors	
12:25 12:40	21	Stefaan J.	Soenen	*Exploring the benefits of nanomaterial and cellular engineering for enhanced therapeutic efficacy.*	
12:40 12:45	Group picture				

12:45 14:00	Cocktail lunch				
14:00 14:35	22	**Invited** Renate	**speaker** Baumgartner	Inclusive AI development through participatory methods	Juha Rantala
14:35 16:00		**Invited** Ali Patrick Wolfgang Merel	**speakers** Ammar Dufour Fecke Hennink	**Panel discussion** – The Future of Cancer Research and Treatment in Europe: Bridging Science, Policy and Innovation	Farouk Allouche Johanne Desbief Ayush Shukla
16:00 16:30	Coffee break				
16:30 17:05	23	**Invited** Stefaan	**speaker** Verbruggen	*Developing and Validating Organ-Chip Models to Better Predict Patient Response*	Sébastien Wächli
17:05 17:20	24	Maria	Antoniou	From Structure to Safety: In Silico Modelling of Biological Effects and Environmental Hazards of Nanomaterials	
17:20 17:35	25	Cintia Belen	Contreras	Rational design of programmable Smart Hybrid Nanosystems for stimuli-responsive drug delivery	
17:35 17:50	26	Subham	Singh	Homologous Tumor-Homing of Cancer Cell-Derived Liposome-Coated Prussian Blue Analogues for Dual-Imaging Guided Photothermal Therapy	
17:50 18:00		Cécilia	Ménard-Moyon	Conclusion	
18:00	End of the conference				

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Talk 1 – Alberto Bianco – Invited speaker

Synthesis, properties and biomedical applications of carbon dots

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Carbon dots are one of the last established classes of carbon materials. They are widely explored as versatile platforms for various applications across multiple fields, including biomedicine. The broad choice of precursors for their synthesis allows to tune their physicochemical characteristics and make them multifunctional systems for varied therapies and imaging [1-4], the latter thanks to their strong photoluminescent properties. In this presentation, I will discuss the different chemical approaches we exploited to prepare carbon dots with controlled chemical structure [5], and present their biomedical applications [1-4]. One of the major concerns, present in the wide literature on carbon dots, is the lack of robust purification methodologies [6]. Often purification steps are overlooked, resulting in lack of accuracy on carbon dot quality [7], eventually used for the different uses. This aspect will be addressed together with the safety aspects [8, 9], including their biodegradability.

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Biography

Dr. Alberto Bianco received his PhD in 1996 from the University of Padova. As a visiting scientist, he worked at the University of Lausanne, the University of Tübingen (as an Alexander von Humboldt fellow), the University of Padova and Kyoto University. He is currently Distinguished Research Director at the CNRS in Strasbourg. His research interests focus on the design of multifunctional carbon and 2D nanomaterials for therapy, diagnostics and imaging. He is also interested on their health impact, particularly on the immune system. He has published more than 390 articles (h-index: 105, > 61000 citations). In 2017 he has been elected Fellow of the European Academy of Science and in 2020 of the Academia Europaea, and in 2019 he has obtained the CNRS Silver Medal. Since 2011 he is Editor of the journal CARBON.

Talk 2 – Chiara Puccinelli

One-Pot Graphitic Encapsulation of Fe_7C_3 Nanoparticles for Enhanced Photothermal Cancer Therapy

Chiara Puccinelli,[1] Lorenzo Riccio,[1] Erica Frostegård,[2] Belén Ballesteros,[3] Martin Schwentenwein,[4] Cécilia, Ménard-Moyon,[2] Laura Maggini[1] and Davide Bonifazi[1]

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Iron carbide nanoparticles offer a sustainable, cost-effective alternative to noble-metal photothermal agents [1], combining strong near-infrared absorption with magnetic functionality relevant to bioimaging, catalysis and hyperthermia [2,3]. Here, we report a one-pot solvothermal synthesis in which Fe_7C_3 nanoparticles direct the *in situ* formation of a conformal, few-layer graphitic carbon shell under comparatively mild conditions (350 °C), a feature not observed for Fe_5C_2 or Fe_3C, which develop only amorphous coatings under analogous conditions. Structural characterization (PXRD, HR-TEM, HAADF-STEM, EELS, Raman, and Mössbauer spectroscopy) confirmed a crystalline Fe_7C_3 core encapsulated by defective graphitic carbon, with minor γ-Fe_2O_3 nanoparticle by-products. Systematic variation of reaction parameters showed that both the Fe_7C_3 phase and a reducing atmosphere (NH_3 or Ar:H_2) are required for graphitization, implicating iron-catalyzed carbon ordering. This graphitic shell translated into markedly enhanced photothermal performance [4]: Fe_7C_3@C nanoparticles achieved a photothermal conversion efficiency of 84±4%, exceeding other iron carbide phases and several noble-metal and carbon-based nanomaterials, [5,6] while retaining stable heating over ten irradiation cycles.

Building on these results, we are now exploring the integration of Fe_7C_3@C nanoparticles into ceramic microneedle patches for localized, minimally invasive treatment of cutaneous melanoma. As a first step, nanoparticles have been successfully embedded within microneedle patch, and photothermal heating under laser irradiation has been measured in cylindric prototypes, confirming retained light-to-heat conversion. In vitro and ex vivo evaluation of this delivery platform is planned as the next stage of this work, moving toward a safer nanomedicine strategy for skin cancer photothermal therapy.

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Talk 3 – Veronika Borggraefe

Molecularly imprinted polymer (MIP) nanogels for biomedical applications

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Dysregulated cell proliferation is a hallmark of cancer. Aberrant activation of the cyclin-dependent kinase 4 and 6 (CDK4/6) pathway enables uncontrolled proliferation of breast cancer cells. The subsequent approval of CDK 4/6 inhibitors for hormone receptor-positive (HR+) and human epidermal growth factor receptor 2-negative (HER2-) metastatic breast cancer established cell-cycle regulation as a potential target in oncology. [1] The objective of this project is to employ molecular imprinting technology to synthesise synthetic antibody mimics (molecularly imprinted polymers, MIPs) that bind and sequester the target protein, for targeted therapy.

MIPs exhibit antibody-like affinity and selectivity, yet are inexpensive, stable, and chemically tunable for biocompatibility. [2] In this project, MIPs are synthesised as polyacrylamide nanogels using solid-phase synthesis. [3] Physicochemical characterisation of the nanogels was conducted, as well as the assessment of the affinity and selectivity properties of the MIPs with respect to the selected target.

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Talk 4 – Lorenzo Riccio

Thermoresponsive p(NIPAM-co-NIPMAM)-Iron Oxide Hydrogels Composite for Localized Antimicrobial and Cancer Therapies

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Thermoresponsive hydrogels offer an attractive route for localized and externally controlled drug delivery [1]. Here, p(NIPAM-co-NIPMAM)-based hydrogel systems containing iron oxide nanocubes are developed for antimicrobial [2,3] and cancer-therapy applications [4]. For antimicrobial treatment, macroscopic hydrogel patches loaded with gentamicin or vancomycin and iron oxide nanocubes are designed to enable controlled antibiotic release upon external heating. In the initial system, 808 nm laser irradiation of the nanocube-containing patches promotes rapid release, providing a potential strategy to reduce uncontrolled passive drug delivery. Using the same material concept, PNIPAM or p(NIPAM-co-NIPMAM) nanogels containing iron oxide nanocubes are investigated as multifunctional cancer-therapy platforms. Under an alternating magnetic field, heating of the magnetic nanocubes is expected to trigger nanogel deswelling and drug release. In parallel, the iron-containing nanocubes can participate in Fenton-like reactions, potentially generating reactive oxygen species and enabling a chemodynamic therapeutic contribution. The nanocubes and nanogel systems are characterized by XRD, TGA, DLS, and TEM to assess their crystalline structure, composition, size, colloidal behavior, and morphology. These systems demonstrate the potential of iron oxide nanocube-loaded thermoresponsive hydrogels as modular platforms that combine externally triggered drug delivery with antimicrobial activity or ROS-mediated cancer therapy.

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Talk 5 – Ayush Shukla

Societal and Ethical Aspects of Cancer R&D: Imagining Therapeutic Futures

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The future of cancer research and care is anticipated to be shaped not only by rising cancer incidence, but also by a proliferation of technoscientific innovations in screening, diagnostics and treatment. These technologies are not simply material artefacts; they also carry visions of what is considered good therapy and good care. Scholars in Science and Technology Studies (STS) have long examined the visions and imaginaries underlying technological development, showing how they embody certain political and societal assumptions about the futures they envision as possible and desirable. As these visions reinforce particular ideas about what is valuable and desirable for society, they also need wider societal reflection. This presentation discusses therapeutic futures co-created within MELOMANES, an interdisciplinary melanoma therapy research consortium. It further explores the societal and ethical aspects of cancer therapy research and development through four therapeutic futures representing imagined futures of cancer therapy and care in different socio-political and economic structures. These futures raise questions about the relationship between healthcare systems and research ecosystems, access to treatment, public-private collaboration and societal values. They also invite us to ask who gets to shape the future of cancer care, whose priorities and values are reflected in R&D and which innovations are enabled or constrained by systemic conditions. By exploring these questions through the co-creation of therapeutic futures, the presentation examines how societal and ethical considerations can become visible within cancer R&D.

Talk 6 – Daina Romeo – Invited speaker

Good for patients and the planet: the role of LCA in the pharmaceutical sector

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Beyond delivering high-quality care for patients, healthcare systems are also working on reducing their burden on the environment [2], conscious of their non-negligible (5%) contribution to global GHG emissions [1]. Life Cycle Assessment is the leading methodology to assess the environmental footprint of products and services along their full life cycle, but how does this apply to the healthcare sector and in particular the pharmaceutical industry? The sector has key characteristics that have an impact on the role of LCA as emission reduction enabler: critical role in society, patient-centered, highly-regulated, long R&D-to-market timelines, highly confidential data [3]. Until recently, no specific rules existed for the LCA of pharmaceutical products, meaning that each practitioner would define system boundaries and modeling rules. This has changed with the release of PAS 2090 [4], the first international standard for the LCA of pharmaceuticals. Common rules are key for a sector with such high stakes. PAS-compliant LCAs of commercial products offer comprehensive and in depth understanding of product hotspots; however, at this stage acting is costly and constrained. Understanding the key drivers of impacts can inform and complement LCAs in early phase of development, when data is incomplete but processes and not yet locked. The impact of a pharmaceutical product is however only part of the story. Comparing medicines is notoriously difficult, as their functional unit relates to the treatment or prevention of a disease. Widening the scope, the inclusion of environmental impacts in the patient care pathway assessment provides a more complete picture [5].

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Biography

Dr. Daina Romeo currently works at Hoffmann-La Roche as Life Cycle Assessment Lead for the Pharmaceutical Division. She is responsible for conducting LCAs of Roche pharmaceuticals, both for commercial and development products, to cover regulatory requirements as well as to identify impact hotspots and enable the improvement of products' environmental performance. Daina holds a PhD Degree from ETH Zurich, where she developed a novel extrapolation procedure for the use of nanomaterials' in vitro toxicity data to develop human toxicity effect factors for the LCA methodology. Across her career, she loves how through LCA she can extensively learn about products and processes, and connect with different functions and experts. Beyond work, she loves plants, psychology and intersectional feminism readings, and exploring nature.

Talk 7 – Erica Frostegård

Synthesis of IONC@PDA-Cu^{2+} for Photothermal and Chemodynamic Therapy

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Chimeric antigen receptor (CAR)-T cell therapy has revolutionized the treatment of several hematological malignancies. However, its application in solid tumors is limited by 1) poor infiltration due to the physical structure of solid tumors, and 2) low activity and proliferation caused by the immunosuppressive tumor microenvironment.[1] We aim to overcome these barriers by developing nanoparticles that can generate heat under external stimuli and generate reactive oxygen species (ROS) to remodel the tumor microenvironment and favor the infiltration and proliferation of CAR-T cells. In this regard, we synthesized iron oxide nanocubes (IONCs) with an average size of 23 nm (Figure 1c) using a solvothermal method.[2] They were transferred to water by a ligand exchange with sodium citrate, resulting in highly water-dispersible NPs. The IONCs could generate heat both under alternating magnetic field and NIR laser irradiation. Encapsulating the IONCs with a ~3 nm polydopamine (PDA) shell (Figure 1b, d) improved their photothermal conversion (Figure 1e). Additionally, the catechol-rich PDA coating could coordinate Cu^{2+} ions to enable Fenton-like ROS generation and glutathione depletion. Preliminary *in vitro* studies have been performed to assess the biocompatibility and therapeutic efficacy of the NPs combined with NIR irradiation. Viability studies were performed on several cell lines, and the NPs combined with NIR irradiation were tested on 3D melanoma spheroids.

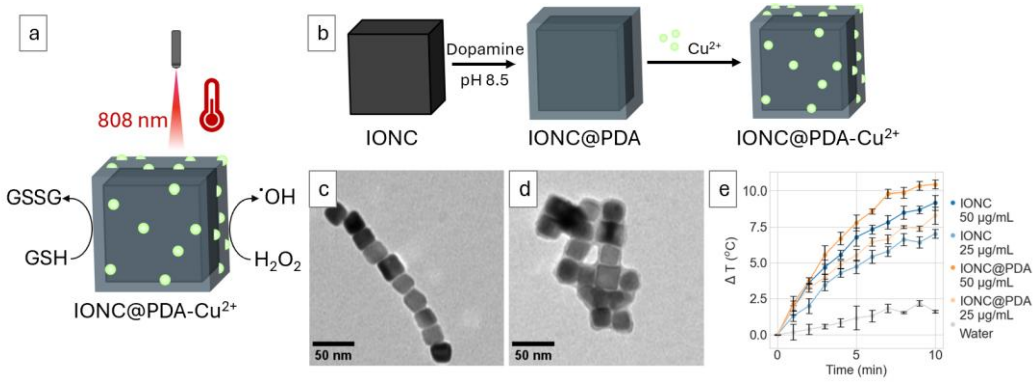

Figure 1. a) Illustration of IONC@PDA-Cu^{2+}. b) Scheme of the synthesis of IONC@PDA-Cu^{2+}. c), d) TEM image of IONC and IONC@PDA. e) Photothermal performance of IONC and IONC@PDA (808 nm, 0.5 W/cm^2).

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Talk 8 – Andreas Reisch

Gold in Plastic: Polymeric Nanoparticles for SWIR Bioimaging

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Luminescence based bioimaging and sensing are powerful tools for advancing in the understanding of biological processes, the behavior of biomaterials in the body, and in biomedicine. A key to achieve this is the design of bright and biocompatible probes that allow studying complex biological systems with high precision.

Here, we present nanoprobes emitting in the Short Wave InfraRed region (SWIR, or NIR II, 1000 – 1700 nm) particularly suitable for in vivo imaging. Indeed, in the SWIR region scattering, absorption, and autofluorescence are strongly reduced, allowing for imaging deep into tissues, but bright probes emitting in the SWIR remain scarce.[1] To achieve bright SWIR probes, large amounts of SWIR emitting Gold nanoclusters (AuNCs)[2] were encapsulated in polymer nanoparticles (NPs). The resulting NPs had sizes from 15 to 70 nm, contained over 10 000 AuNCs, and had a very high single particle brightness.[3] Single particle tracking showed their potential for investigating biological tissues at the nanometer scale.[4] Depending on the surface treatment, long circulation of the NPs upon injection in mice could be obtained, allowing high resolution imaging of blood circulation in vivo. [5]

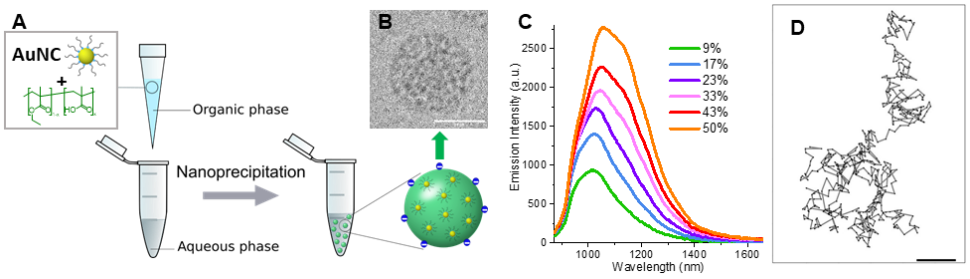

Figure 1. (A) Assembly of Gold nanocluster loaded polymer nanoparticles, (B) TEM image, (C) Photoluminescence spectra, and (D) Single particle tracking.

References

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Talk 9 – Wilder Ruiz

From RNA-seq Toxicogenomics to a Deployed AI-Assisted Research Platform

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We are developing a modular research platform designed to support reproducible bioinformatics analysis, scientific reasoning, and mechanistic interpretation of toxicogenomics data. The platform integrates an RNA-seq workflow layer for dataset-driven analysis, private research workspaces, live scientific data retrieval, and deterministic analysis modules within a unified web-based environment.

The project originated from RNA-seq toxicogenomics analysis of nanoparticle-exposed patient-derived melanoma models, where transcriptomic responses required reproducible preprocessing, pathway-level interpretation, and structured toxicity assessment. To address these needs, the platform combines an AI-assisted reasoning interface with deterministic modules for research retrieval, concept explanation, dictionary support, system diagnostics, computation, and workflow guidance. This architecture separates language-model synthesis from deterministic outputs, helping ensure that scientific responses are supported byverifiable data, computation, or curated knowledge.

The current implementation includes file-based RNA-seq data matrix loading, structural validation, paginated dataset preview, progress-tracked parsing, and structured system reports for valid or invalid inputs. These reports provide scientific context, recommended actions, references, and developer-facing checks, supporting both interpretation and reproducibledebugging. The platform also includes private, login-protected research workspaces for custom project development, supported by MariaDB-backed authentication, role management, permissions, and session control. A MariaDB-backed scientific terminology layer enables real-time biological autocomplete.

Together, these modules transform the platform from a static RNA-seq analysis and visualization concept into a deployed AI-assisted toxicogenomics platform. The current use case focuses on nanoparticle-induced transcriptomic responses in melanoma, with future development extending toward nanoparticle-specific mechanistic signatures and predictive toxicity modelling.

Talk 10 – Laraib Kiran

Towards gold nanoparticle coating: design and synthesis of a functional trivalent organic platform

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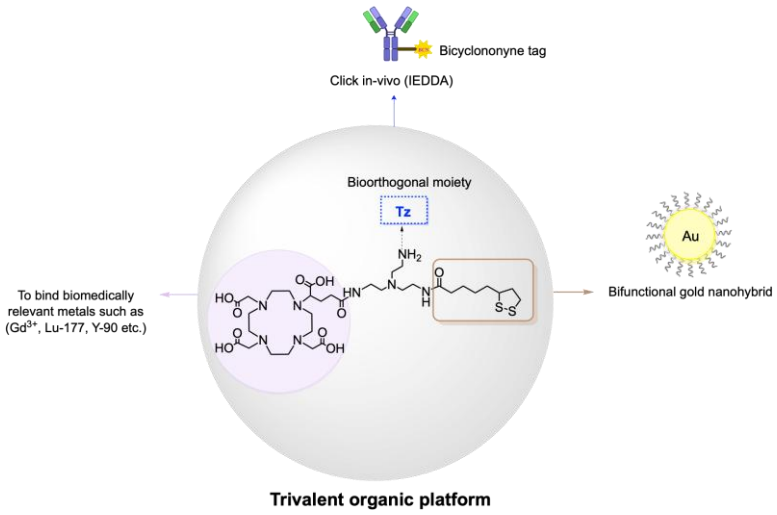
Pretargeting is an emerging strategy offering enhanced specificity and reduced systemic toxicity in targeted delivery applications. [1,2] An organic/inorganic nanohybrid theranostic agent made of a gold nanoparticle (inorganic, therapy) and an organic coating made of a radiocomplex (imaging) would need an additional feature, such as a hanging and highly reactive bioorthogonal moiety i.e. tetrazine (Tz) to complete the pretargeting strategy. A synthetic scheme leading to the organic coating will be disclosed, which the nanohybrid is made of and which makes it functional, with respect to both its imaging and targeting features. The scheme will report protection/ deprotection strategies on a multivalent platform aimed at hosting a chelate (the future radiocomplex for imaging), a linker designed to firmly attach the platform onto the gold nanoparticle, and the hanging function of interest (Tz) for the pretargeting strategy. Upon such a platform decoration, its performance will be validated via various control experiments involving successful appending onto the gold nanoparticle, conjugation to Tz, click (IEDDA) reaction, and complexation.



General representation of trivalent organic platform highlighting future applications of each functionality leading towards theranostics.

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Talk 11 – Daniel Rieger

Development of a perfused melanoma-on-a-chip model to evaluate efficacy and toxicity of a CAR T-cell therapy

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Preclinical models like microphysiological systems (MPS) are at the forefront of cancer research. However, models capable of capturing the full immunological cascade of immunotherapeutic agents such as CAR T-cells from circulation in the bloodstream, vascular transendothelial migration, and infiltration into primary tumors remain scarce. Recreating the physical and biochemical barriers imposed by the tumor microenvironment by such advanced in vitro systems is critical for investigating CAR T cell performance against primary tumors, while simultaneously providing insights into potential adverse effects.[1] As part of Melomanes, an EU-wide research consortium dedicated to the development of an immunotherapy combining anti-HLA-G CAR T cells and magnetic nanoparticles capable of inducing localized hyperthermia, this project aims to develop an advanced melanoma-on-a-chip MPS to evaluate therapeutic efficacy and safety of CAR T-cell therapy. This model is developed using the PhysioMimix® platform (CN Bio Innovations), providing recirculating medium flow to mimic blood circulation. A Transwell®-based dual-compartment approach enables chemokine-driven immune cell migration across a HUVEC layer and subsequent investigation of immune cell activity against malignant tissue in a controlled microphysiological environment. Such human-based preclinical models offer a roadway to predictive success whilst reducing the reliance on animal models.

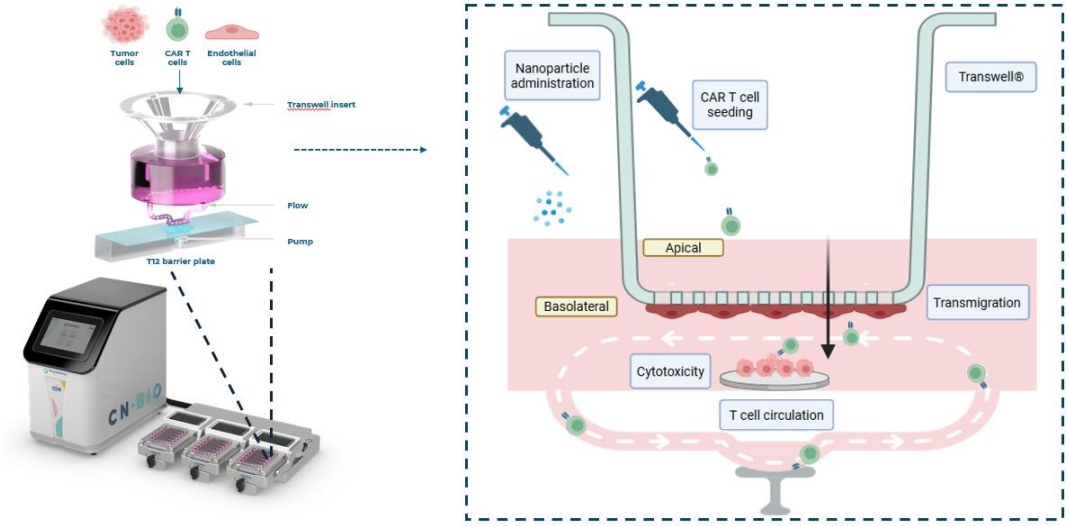

Figure 1. Establishment of melanoma-on-a-chip model on perfused MPS platform

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Talk 12 – Amaia Cipitria – Invited speaker

Injectable and viscoelastic click alginate hydrogels for spatio-temporal T-cell administration *in vivo*

Jone Berasain[1,2], Irati Aiestaran-Zelaia[1], Sara Manzano[3], Oihane Mitxelena-Iribarren[1], Unai Heras[1,4], Ainhoa Romo-Valera[3], Peio Azcoaga[3], Leire Iturriaga[1], Leire Egia-Mendikute[5], Asís Palazón[5,6], Mercedes Fernández[2,7], María M Caffarel[3,6], Robert Aguirresarobe[2,7], Amaia Cipitria[1,6]

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T cell therapies show limited success in solid tumors, due to poor tissue penetration. Here, we develop injectable, viscoelastic click alginate hydrogels for local and sustained delivery of T cells to improve their administration, viability, proliferation, and persistence in vivo [1]. Oxidized alginate (Alg) was functionalized with norbornene-to-tetrazine for inverse electron demand Diels-Alder covalent click crosslinking at low (1% Alg) and high (2% Alg) alginate concentrations. 1% Alg hydrogels showed better injectability in a fully crosslinked state, characterized by lower stiffness, larger mesh size, viscoelastic behavior, lower injection forces and higher cell viability upon injection. In vitro, 1% Alg supported T cell viability and proliferation, and promoted sustained release for 10 days. Using a chicken in vivo chorioallantoic membrane model, hydrogel-based T cell administration exhibited better local delivery, proliferation and persistence over time compared to bolus injection, with 1% Alg showing enhanced T cell release compared to 2% Alg. Further, in a murine model with a local injection in the mammary gland, 1% Alg showed enhanced T cell persistence within the mammary gland and high tissue integration. Next, we demonstrated that primary CAR-T cells maintain viability inside the hydrogel, and released cells from the hydrogel retain cytotoxic activity against tumor cells in vitro. Currently, we are evaluating their therapeutic efficacy in orthotopic breast cancer models. In conclusion, we engineered injectable, viscoelastic click alginate hydrogels that support T cell administration, local injection, viability, proliferation and persistence in vivo, opening future opportunities for spatio-temporal control of T cell immunotherapies in various tumor types.

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Biography

Prof. Amaia Cipitria is an IKERBASQUE Research Professor, head of the Bioengineering Area at Biogipuzkoa Health Research Institute, Spain, and leads the group "Bioengineering in Regeneration and Cancer". Her group aims to understand how biophysical and biochemical properties of native extracellular matrix and synthetic biomaterials guide cell response in tissue regeneration, cancer dormancy and bone metastasis. Amaia obtained her Ph.D. in Materials Science and Metallurgy at the University of Cambridge, UK (2008). Since then, her scientific career has evolved from Engineering and Classical Materials Science (UK), to Biomaterials and Tissue Engineering at Queensland University of Technology (QUT) (Australia) and Charité University Hospital Berlin (Germany). Relevant scientific contributions include the use of 3D printed scaffolds to regenerate critical-sized bone defects in sheep (Sci Transl Med 2012), or the use of advanced materials science methods to investigate the effect of curvature on in vivo tissue formation (Acta Biomater 2017). As a junior PI at the Charité, her group focused on engineering the cell microenvironment, modulating biophysical and biochemical cues (Biomaterials 2018, Biomaterials 2019, Acta Biomater 2020, Biomat Adv 2023). More recently, Amaia has embarked in the field of Biomaterials and Cancer, first with a DFG Emmy Noether grant (2017) as group leader at the Max Planck Institute of Colloids and Interfaces (MPI-CI) (Germany), later as a tenured IKERBASQUE researcher (2021) (Spain). Her interdisciplinary team investigates cancer dormancy and early bone metastasis, combining (i) in vitro models with hydrogels and microfluidics (Soft Matter 2021, PNAS 2022, Lab on a Chip 2023, Science Advances 2024, ACS Nano 2024) with (ii) in vivo mouse models of breast cancer bone metastasis (Science Advances 2024). She also serves as associate editor of the journal Biomaterials Advances. In 2024, she was awarded an ERC Consolidator Grant (DORMATRIX, 101123883) to bioengineer cancer dormancy as a collective emergent phenomenon, and the Ikerbasque Prize – Recognition of Women Researchers. In 2025, she was awarded the Premio Constantes y Vitales "Joven Talento en Investigación Biomédica". Originally from San Sebastián located on the Atlantic coast, she loves traveling with her family in a van to the mountains and seaside.

Talk 13 – Jacopo Sorani

From Laboratory Protocols to Scale-Up: Two Digital Tools for Prospective LCA of Fine Chemicals, Pharmaceuticals and Nanomaterial

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The transition from laboratory discovery to industrial production is a critical stage for embedding sustainability, safety and resource efficiency into the development of fine chemicals, pharmaceutical products and nanomaterials. However, early-stage environmental assessments are often based on incomplete laboratory data and simplified extrapolations that fail to capture scale-dependent changes in process configuration, equipment, energy demand, solvent recovery and waste generation [1,2]. This work presents two complementary digital tools developed to support more reliable and transparent scale-up within prospective life cycle assessment (LCA) [1] and Safe and Sustainable by Design (SSbD) [3,4] workflows. The first tool is a phenomena-based scale-up framework [5] that translates laboratory protocols into industrially representative process flowsheets [6]. It decomposes experimental procedures into physical phenomena and process tasks, identifies scale-sensitive operations [2], and guides the selection of industrial unit operations, recycling loops, waste streams and preliminary production schedules. The second tool, EnerFlox, is a modular energy-calculation platform that estimates heat, cooling, pumping, mixing, separation and drying requirements from limited process information. The calculated energy duties are linked to equipment efficiencies and structured life-cycle inventory data [7]. The framework and toolset are now being adapted to pharmaceutical manufacturing and nanomaterial production. Together, these tools provide a reproducible bridge between laboratory experimentation, process engineering, to support sustainability assessment, enabling environmental hotspots and improvement opportunities to be identified before industrial implementation [8].

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Talk 14 – Maria Loustau/Julien Caumartin

Abstract

Lipid nanoparticles (LNPs) have established nucleic acid delivery as a clinically validated, scalable and highly efficient therapeutic modality, but remain constrained by extrahepatic targeting, cell-type selectivity, repeat dosing and immunogenicity. Extracellular vesicles (EVs) offer a biologically complex interface with intrinsic intercellular communication properties, yet their translation is limited by heterogeneity, inefficient cargo loading, analytical complexity and challenging clinical-scale manufacturing.

Hybrid EV-LNP systems aim to integrate these complementary strengths by using the LNP as a formulation and cargo-loading module and the EV as a biological interface capable of modulating particle-cell and particle-tissue interactions. Current studies indicate that controlled hybridization can preserve EV membrane proteins and biological activity, incorporate multiple RNA cargos, and enhance in vitro transfection relative to the corresponding non-hybridized lipid nanocarrier. However, clinical evidence for superior targeting, safer repeat administration, or improved tolerability is still lacking.

We explore the most plausible medical applications of EV-LNP hybrids, including in vivo immune-cell engineering, immuno-oncology, extrahepatic gene therapy, regenerative medicine, and targeted immunomodulation. We propose that hybrid systems are unlikely to replace LNPs as a general delivery platform, but may emerge as a distinct class of precision vectors in settings where the biology of the particle-tissue interface becomes the dominant therapeutic limitation. Their clinical future will depend on demonstrating clear head-to-head advantages over existing delivery systems while establishing robust quality attributes and reproducible, scalable pharmaceutical manufacturing.

Talk 15 – Amalie Leinebo

Nanohyperthermia and CAR-T combination therapy for melanoma: An *in vitro* screening workflow

Amalie Leinebo,[1] Tatiana Bobrova,[2] Sonia Becharef, [1] Dmitry Ayollo, [1] Stephane Roux, [3] Emmanuel Donnadieu, [2] Florence Gazeau[1]

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While animal models remain indispensable in cancer research, they are limited by cost, throughput and ethical concerns. The increased focus on refinement and replacement of animal testing demands development of more complex in vitro models mimicking essential properties of the tumor microenvironment [1].

In this context, we have developed a robust and predicative in vitro screening platform for assessing and comparing efficacy of monotherapies and combination anti-cancer treatment strategies. The platform employs reproducible 3D tumor spheroids, which are monitored over several days by automated time-lapse multichannel imaging. The versatility of this screening platform allows for systematic investigation and parameter tuning of the applied therapy, and can be compared across different tumor models. Additional readouts complementing the temporal imaging data, such as cytokine profiling or immunophenotyping, can be easily integrated for a comprehensive multiparametric readout.

The screening platform has been adapted to the Melomanes project, aiming to develop a therapeutic approach combining HLA-G-targeted CAR-T immunotherapy with nanoparticle-induced hyperthermia. 3D melanoma spheroids have been successfully established and integrated into a screening workflow, including a Python-based image analysis quantifying tumor cell death and spheroid disruption kinetics. Preliminary screening experiments have validated CAR-T efficacy and defined key parameters for combination therapy testing. Firstly, HLA-G-specific activity of anti-HLA-G CAR-T cells was confirmed by comparing cytotoxicity in coculture with spheroids of high and low HLA-G-expression. Secondly, CAR-specific activity was confirmed against non-transduced T-cells in HLA-G-expressing spheroids. Lastly, the experiments have identified suitable effector-to-target ratios of CAR-T-cells and spheroid HLA-G-expression levels to employ for combination treatment testing.

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Talk 16 – Shayamita Ghosh

Iron oxide nanoparticle driven hyperthermia for tumor extracellular matrix remodeling in metastatic melanoma

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Metastatic melanoma (MM) is hard-to-treat disease and mainly consist of cancer cells, abnormal vasculature, immune cells, extracellular matrix (ECM) collectively known as tumor-microenvironment (TME). [1] ECM acts as significant barrier for therapeutic agent infiltration, leading to treatment efficacy reduction. [2, 3] Conventional therapies often cause toxicity or resistance, emphasizing the need for improved treatment. [4] Chimeric Antigen Receptor (CAR)-T cell therapy is significantly promising in treating hematological cancers, but efficacy with solid tumors remain restricted. Within the framework of MELOMANES project, we aim to improve MM therapy by altering the ECM using Iron-oxide nanoparticle (NPs) driven hyperthermia, thereby improving CAR-T cell mediated killing.

Here, we aim to alter the TME by triggering hyperthermia with NPs, comparing magnetic and laser stimulation in melanoma *ex vivo* tumors. So, we intratumorally injected NPs into solid subcutaneous melanoma tumors *in vivo* and waited 24 hours before euthanization. Then we performed magnetic and photothermal hyperthermia on the isolated tumors in the presence of culture medium for 3 consecutive days. Alterations in the ECM were assessed using different histological techniques, specifically Hematoxylin and Eosin and Sirius Red staining, and at the molecular level by fluorescent collagen-binding peptide. The result supported significant alteration of collagen structure and cellular death induced by magnetic and photothermal hyperthermia in the tumor.

This *ex vivo* strategy is straightforward with intact TME, avoids the need for hyperthermia setups in animal facilities or transportation of live animals, provides predictive platform for future *in vivo* studies. Overall, this approach represents promising to achieve superior therapeutic outcome for MM.

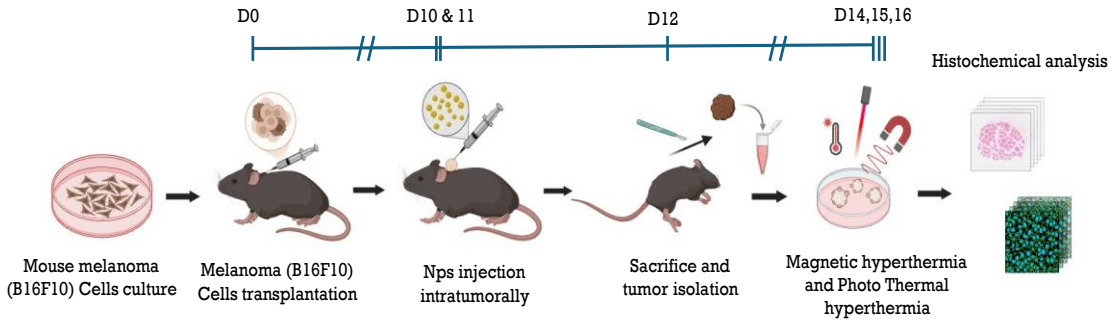

Figure 1. Schematic overview of the experimental workflow for nanoparticle-mediated hyperthermia, including B16F10 melanoma tumor induction, nanoparticle injection, hyperthermia treatment, and subsequent histochemical analysis.

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Talk 17– Iseult Lynch – Invited speaker

Biomolecular coronas as a mechanistic link between nanoparticle design, biological identity and safe-by-design nanomedicine

Iseult Lynch[1]

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Despite major advances in nanomedicine, clinical translation remains limited by our ability to predict how engineered nanomaterials behave in complex biological environments. Central to this challenge is the formation of the biomolecular corona, a dynamic layer of proteins, lipids, metabolites and other biomolecules that adsorbs onto nanomaterial surfaces upon exposure to biological fluids and ultimately defines their biological identity.

This presentation examines how the biomolecular corona provides a mechanistic bridge between nanoparticle physicochemical properties and biological outcomes. Drawing on research spanning environmental and biomedical nanoscience, the talk demonstrates how material properties, including size, morphology and surface chemistry, influence corona composition and evolution, thereby governing cellular uptake, immune recognition, biodistribution, therapeutic efficacy and toxicity [1, 2, 3].

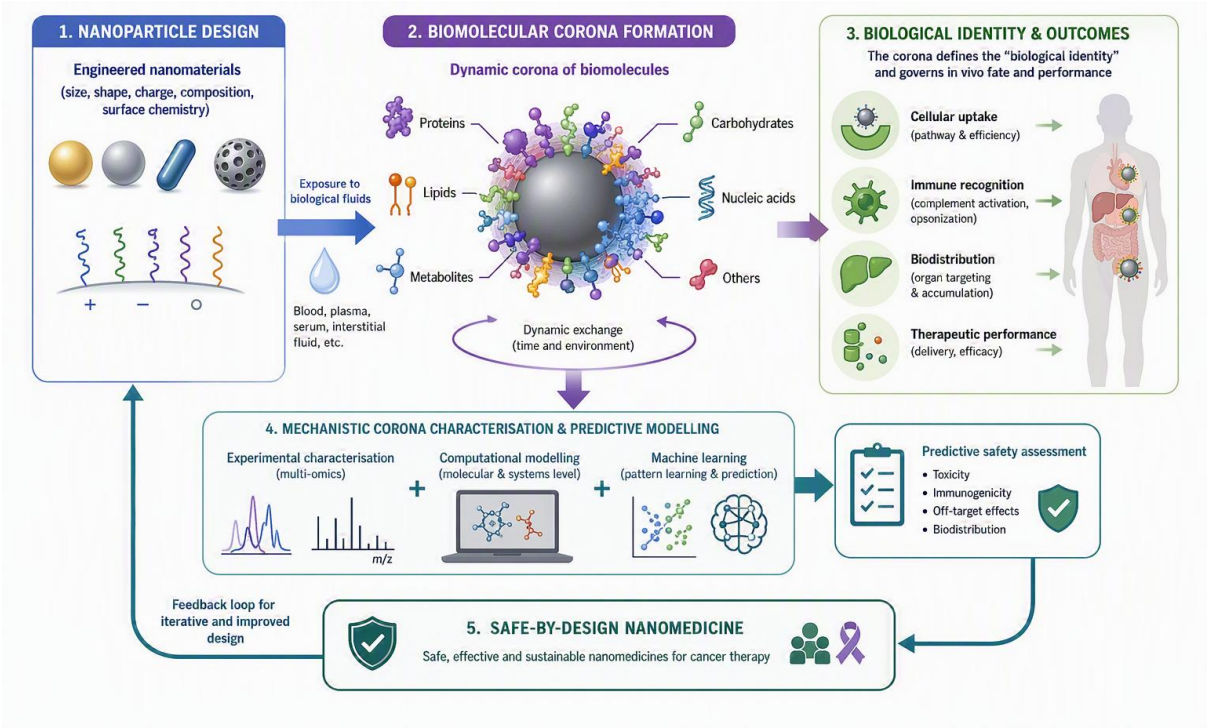

Figure 1. Biomolecular coronas as a mechanistic link between nanoparticle design, biological identity and safe-by-design nanomedicine. Following exposure to biological fluids, engineered nanomaterials acquire a dynamic biomolecular corona comprising proteins, lipids, metabolites and other biomolecules. This corona defines the biological identity of the nanoparticle and governs cellular uptake, immune recognition, biodistribution and therapeutic performance. Integration of mechanistic corona characterisation with computational modelling and machine-learning approaches enables predictive safety assessment and supports the development of safe

and sustainable nanomedicines for cancer therapy. Particular emphasis will be placed on emerging approaches that combine high-resolution corona characterisation with computational modelling, machine learning and systems toxicology to predict nano–bio interactions and biological responses. Recent advances are enabling the development of predictive frameworks that link material design directly to safety and performance outcomes across diverse nanomaterial classes [4, 5] Finally, a demonstration of the use of corona-informed models to support next-generation safety assessment and Safe-and-Sustainable-by-Design (SSbD) principles for nanomedicine will be presented, reducing uncertainty during development and facilitating regulatory decision-making. Such mechanistically informed approaches offer a pathway towards accelerated translation of safer, more effective and more sustainable nanotherapeutics, particularly for cancer therapy.

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Biography

Prof. Iseult Lynch is an environmental chemist working at the interface of chemical (and materials) pollution and environmental policy. She is the Director for Research of the University of Birmingham's Centre for Environmental Research and Justice (CERJ), an affiliate of the Birmingham Institute of Sustainability and Climate Action, Chair of DEFRA's Hazardous Substances Advisory Committee (HSAC) advising the UK government on all aspect of chemicals in the environment, a Fellow of the Royal Society of Chemistryand an Editorial Board member of *Environmental Science: Nano.*

Iseult has a very broad overview of all aspects of nanomaterials and chemical safety assessment and plays a leading role in making toxicology research data and models Findable, Accessible, Interoperable and Re-usable (FAIR). She co-leads the workpackage on FAIR Research data for the EU Horizon Europe funded Partnership for Assessment of the Risks of Chemicals (PARC) and is the Chemical Lead for nanomaterials.

Iseult's research focuses on the environmental interactions of nanoparticles and nanostructured surfaces with biological entities from macromolecules to organisms, and the interactions of nanoscale materials with other co-pollutants as part of mixture toxicity. She collaborates with a wide range of colleagues internationally, to develop predictive modes of nanomaterials toxicity, to develop safe and sustainable by design materials and chemicals, and to apply nanoscale and advanced materials in a range of applications to support the United Nations Sustainable Development Goals, including for precision agriculture, for water purification and for clean energy.

Iseult is part of the Birmingham Plastics Network, an interdisciplinary team of more than 40 academics working together to shape the fate and sustainable future of plastics. This unique team brings together chemists, environmental scientists, philosophers, linguists, economists, and experts in many other fields, to holistically address the global plastics problem.

Talk 18 – Tatiana Bobrova

HLA-G–targeting CAR T cells in melanoma: Role of IFNγ signaling in tumour cell sensitivity and resistance mechanisms

Tatiana Bobrova[1], Amalie Leinebo[6], Emilia Rabia[1], Mattia Fumagalli[1], Alice Machado[1], Irena Rajnpreht[1], Marion Bonhomme[1], Cristabelle de Souza[2], Maximillian Heist[3], Maria Loustau[4], Caroline Robert[1], Sébastien Walchli[5], Emmanuel Donnadieu[1].

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CAR T-cell therapy has revolutionized the treatment of hematological malignancies, with multiple CAR T-cell therapies approved for clinical use. However, their application to solid tumours remains challenging, and only recently has the first CAR T-cell therapy been approved in this setting. Major challenges include the limited availability of tumour-specific antigens and the emergence of resistance mechanisms. Conventional melanoma therapies show limited efficacy and often cause significant side effects. Here, we validate HLA-G as a novel target for CAR T-cell therapy in melanoma. Using multiple preclinical models including 2D cultures, 3D spheroids, and patient-derived tumor slices we demonstrate promising CAR T-cell efficacy. Given that melanoma patients often develop resistance to immunotherapies through mutations in the IFNγ signaling pathway, our work also investigates mechanisms underlying resistance. We show that intact IFNγ signaling is critical for CAR T-cell–mediated killing, Deciphering the mechanisms of IFNγ-mediated sensitivity and identifying strategies to overcome IFNγ resistance are essential steps toward improving CAR T-cell immunotherapy for melanoma patients.

Talk 19 – Stéphane Roux

Gold-based nanostructures designed for image-guided therapy

Gautier Laurent[1,2], Asli Goctu[1,2], A. Nicolás-Boluda[3], Sonia Becharef[3], Ali Shakeri-Zadeh[4], Chahrazad Benbalit[1], Laila Yazigi[1], Victoria Aparicio[1], Rana Bazzi[1], Arnaud Béduneau[2], Jeff Bulte[4], Florence Gazeau[3], Stéphane Roux[1]

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Among the nanostructures developed for medical applications, gold nanoparticles received much attention. Their properties are very well-suited for biodetection, imaging and remotely controlled therapy. The gold nanoparticles are mainly known for their tunable optical properties which can be exploited for photoacoustic imaging (PAI) and for photothermal therapy (PTT). However, the therapeutic activity of the gold nanoparticles is not limited to the exploitation of their optical properties. Owing to the high atomic number of gold element (Z(Au) = 79), Hainfeld and his coworkers demonstrated in pioneering studies that the gold nanoparticles permit to enhance the effects of radiotherapy, whatever their size and their morphology.[1] Since half of patients with a cancer are treated by radiotherapy, the radiosensitizing effect of the gold nanoparticles constitutes a valuable asset for their application in clinic.

In this context, we designed multifunctional gold nanoparticles coated with gadolinium chelates. These nanoparticles exhibited a high potential for radiotherapy guided by magnetic resonance imaging (MRI).[2][3]

To make them even more effective, we have been seeking in recent years to improve their pharmacokinetics and tumor retention time. Moreover, we tried to enlarge their palette of therapeutic activity by combining radiosensitization with other strategies such as chemotherapy, hyperthermia and immunomodulation. [4][5][6] For achieving these goals, we explored different strategies.

Through this presentation, I would like to highlight the benefit for these gadolinium chelate-coated gold nanoparticles to be associated with large biodegradable nanocarriers.

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Talk 20 – Thibault Leray

A novel highly melanoma-specific TCR-T cell product demonstrates safe and enhanced responses against melanoma solid tumors

Thibault Leray[1,2], Gwenann Cadiou[1], Manaarii Tchen Ping Lei[1], Ali Telet[1], Tiffany Beauvais[3,4], Sébastien Wälchli[1], Nathalie Labarrière[3,4], Else Marit Inderberg[1]

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Among cellular immunotherapies in the treatment of metastatic melanoma, T-cell Receptor (TCR)-based therapy is one of the most promising. However, two longstanding challenges, both crucial for successful therapy, remain; the selection of a highly tumor-specific antigen and sufficient responses to overcome a complex and immunosuppressive tumor microenvironment. [1] In this study, we focused on a TCR derived from a peripheral blood $CD8^+$ T cell clone from a patient treated with immunotherapy, and specific for MELOE-1,an immunogenic non-conventional melanoma-specific antigen. [2,3]

Primary T cells were retrovirally transduced with natural or murinized versions of this TCR.[4] Results showed that murinization of both α and β-constant domains improved TCR expression (fold change>4). Functional assays demonstrated that improved TCR expression was consistent with increased reactivity against endogenous MELOE-1 antigen in melanoma cell lines and superior cytotoxicity. Our data show that this reactivity of the engineered TCR-T cells persists upon multiple sequential antigen exposure. MELOE-1 TCR-T cells also displayed substantial invasion capacity in 3D models of melanoma compared to non-TCR modified T cells, reinforcing their encouraging therapeutic potential. Additionally, no toxicity against melanocytes from healthy donors was detected, suggesting that our optimized TCR prevails as a melanoma-specific and safe therapy. Finally, TCR-T cell efficacy was assessed *in vivo* in NXG mice injected with melanoma cell lines, and engineered TCR-T cells were able to control tumor growth.

Altogether, these data support the further development of a promising TCR-based T-cell therapy that may be combined with other therapeutic approaches for highly personalized therapies against refractory melanoma.

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Talk 21 – Stefaan Soenen

Exploring the benefits of nanomaterial and cellular engineering for enhanced therapeutic efficacy

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The biomedical potential of nanomaterials has attracted sustained interest for decades. However, despite compelling preclinical proof-of-concept studies, the clinical translation of nanomedicines has remained limited. A major barrier is the incomplete understanding of nanoparticle biodistribution, cellular uptake, and biological effects following systemic administration. In this presentation, we highlight how recent advances in quantitative imaging and analytical technologies are helping to overcome these challenges and accelerate the rational development of nanomedicines.

We will focus on two complementary strategies: engineering nanoparticle crystals to enhance anticancer activity and employing biomimetic cellular engineering approaches to improve the delivery of therapeutic nanoformulations to solid tumors. In particular, we demonstrate how state-of-the-art preclinical imaging enables quantitative mapping of nanoparticle biodistribution while revealing the spatial and cellular heterogeneity of nanoparticle uptake within the tumor microenvironment. These insights provide a framework for optimizing nanoparticle design and targeting strategies to maximize therapeutic efficacy. Representative examples will illustrate how inorganic nanoparticles can suppress metastatic progression, stimulate anti-tumor immune responses, and, through biomimetic delivery platforms, enhance the efficacy of gene-based nanoformulations designed to induce immunogenic cell death.

By integrating advances in quantitative imaging with innovative nanoparticle engineering, this presentation will illustrate how mechanistic insight into nanoparticle fate and function can inform the design of more effective nanomedicines, ultimately helping to bridge the gap between promising preclinical discoveries and successful clinical translation.

Talk 22 – Renate Baumgartner – Invited speaker

Inclusive AI development through participatory methods

Renate Baumgartner

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Artificial intelligence (AI) is seen as panacea for better health including more health equity. However, studies show that AI alone cannot solve health issues and systemic problems in healthcare. Multiple examples also show how AI may even reproduce existing bias and discrimination. Depending on the backend or frontend of an AI-tool, we can identify different points where bias is introduced. On the back end it can be missing, erroneous are low quality data which leads to not representative training data and low-quality outcomes for particular groups of people. On the frontend of a tool low usability can lead to a lower accessibility of tools particularly for less tech-savy (lay)users. This presentation will draw on digital health technologies (DHTs) as examples of AI: skin cancer detection tools used by laypeople for skin cancer prophylaxis and a digital companion for people with chronic obstructive pulmonary disease. The analysis of skin cancer detection tools illustrates how bias can find its way through the backend of an application. Not representative training data can indeed lead to racial bias and to more health inequity. The digital companion for people with a chronic disease shows how participatory methods can be used to develop more inclusive tools which ideally increase access to healthcare and health for underserved groups. Historically, DHTs were primarily developed by technological stakeholders. However, in the meantime, participatory technology development has become a gold standard for inclusive technology development. Design thinking is a particularly well-established method, involving relevant stakeholders, including patients, to ensure the envisioned DHT is genuinely useful for patients. This is particularly crucial when the users are patients, who belong to a vulnerable group such as living in low socio-economic position and having low digital literacy or low health literacy.

Biography

Renate Baumgartner is Assistant Professor of Participatory AI at the Athena Institute of the Vrije Universiteit Amsterdam. Her research focuses on fostering more inclusive AI development through participatory methods, particularly in medicine and healthcare. Renate's perspectives are informed by feminist science and technology studies, as well as sociology. She holds a PhD in sociology from the University of Tuebingen and a PhD in pharmaceutical science from the University of Vienna. Prior to her current role, held a tenured post-doctoral position at the Center for Gender and Diversity Research at the University of Tübingen and worked as a project manager in clinical development. Renate has published in the fields of science and technology studies, sociology of sexuality, medicine, and life sciences.

Talk 23 – Stefaan Verbruggen

Developing and Validating Organ-Chip Models to Better Predict Patient Response

Stefaan Verbruggen
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Organ-on-chip technologies offer exciting opportunities to improve the prediction of patient responses by recreating key aspects of human physiology in controlled microengineered systems. By combining human cells, biomaterials, and physiologically relevant mechanical cues, these platforms can capture critical features of tissue function and disease that are often lost in traditional in vitro models. In our work, we have developed musculoskeletal and bone-on-chip models to investigate mechanobiology, tissue remodelling, and disease processes, including cancer metastasis to bone.

A major challenge for the field is demonstrating that organ-chip models provide clinically relevant and predictive insights. This talk will discuss approaches to validating organ-chip systems through comparison with patient-derived samples, clinical observations, and established preclinical models. I will highlight how these platforms can be used to study disease mechanisms, evaluate therapeutic responses, and support the development of more predictive, human-relevant models for drug discovery and precision medicine, while contributing to the reduction of animal experimentation.

Biography

Dr Stefaan Verbruggen is a Lecturer in Medical Technology at Queen Mary University of London. His research focuses on the mechanobiology of bone cells, and developing predictive in vitro models of cancer metastasis. As a Visiting Academic at the INSIGNEO Institute of in silico Medicine, Dr Verbruggen also builds predictive computational models of the biomechanics of metastatic bone lesions.

Prior to this, Dr Verbruggen conducted his PhD research in bone cell mechanobiology the Biomechanics Research Centre at the University of Galway, followed by postdoctoral research in how fetal movements affect joint development in the Developmental Biomechanics Lab at Imperial College London.

Dr Verbruggen was then awarded a Marie Sklodowska-Curie Research Fellowship at Queen Mary University of London. As part of a collaboration with the Department of Biomedical Engineering at Columbia University, New York, Dr Verbruggen's investigated the mechanobiology of cancer cells, and how they metastasise to bone from other areas of the body. Most recently the Verbruggen Lab was awarded an ERC Consolidator Grant to develop organ-on-a-chip models to pursue this research question further.

Talk 24 – Maria Antoniou

From Structure to Safety: *In Silico* Modelling of Biological Effects and Environmental Hazards of Nanomaterials

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The increasing diversity of engineered nanomaterials (NMs) and their applications pose a practical challenge for Safe-and-Sustainable-by-Design (SSbD): safety information is often required early in the innovation process, when experimental data are still scarce. *In silico* methodologies can help address this gap by linking material properties to biological and ecological effects, and by supporting the derivation of quantitative environmental hazard thresholds.

This work presents approaches addressing biological and environmental aspects of nanomaterial safety. For biological effects, nanoQSAR and machine learning models are developed to evaluate toxicity for data-poor material-endpoint combinations. Particular emphasis is placed on enriching sparse nano-safety datasets with computational descriptors derived from nanoparticle crystalline structures. These supplementary attributes allow information on surface and bulk atomic environments to complement conventional physicochemical descriptors [1]. Model development follows established QSAR principles, including applicability domain assessment, uncertainty quantification and model interpretation. At the environmental level, species sensitivity distributions (SSDs) are investigated as a means of translating ecotoxicity data into hazard concentrations relevant to environmental risk assessment [2]. NanoSSD, is a web platform that summarises data across aquatic, terrestrial and sediment compartments and enables the fitting and comparison of alternative statistical distributions for deriving HCx values and associated uncertainty. These estimates can subsequently support the derivation of predicted no-effect concentrations and, when combined with environmental exposure estimates, risk characterisation [3].

Together, nanoQSARs and NanoSSD address two needs in the SSbD domain: predicting biological effects when data are scarce and converting ecotoxicity data into environmentally relevant threshold values. The web services presented can be used for early-stage safety assessment of NMs and to support evidence-based decisions within SSbD [4].

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Talk 25 – Cintia Belen Contreras

Rational design of programmable Smart Hybrid Nanosystems for stimuli-responsive drug delivery

Maria de los Ángeles Cabrera Molina,[1] Lourdes Franco,[1] Juan Cruz Bonafe Allende,[1] Maria Lúcia Schumacher,[1] Estefania González Solveyra,[1] Galo Soler Illia,[1] Cintia Belen Contreras,[1]
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Stimuli-responsive nanosystems have emerged as promising platforms for advanced applications, particularly in drug delivery, owing to their ability to undergo controlled physical or chemical transitions in response to external stimuli such as pH, temperature, light, and magnetic fields.[1] Inspired by the adaptive behavior of living systems, these materials can integrate sensing and responsive functionalities, enabling controlled and localized therapeutic delivery. In this context, organic–inorganic hybrid nanomaterials offer versatile architectures and tunable interfacial properties, providing a powerful platform for the development of smart nanosystems with enhanced functionality and potential for site-specific drug release while minimizing systemic side effects.[2]

In this work, we present the design and synthesis of a modular platform of Smart Hybrid Nanosystems (SHN), programmable and adaptive, based on reproducible and potentially scalable orthogonal synthesis and functionalization strategies. The proposed hybrid nanocarriers integrate three functional domains within multilayer core–shell–polymer colloids: a heating module based on either gold nanoparticles or superparamagnetic iron oxide nanoparticles (SPION), a silica layer providing core stabilization and surface-chemistry compatibility, and a polymeric domain responsible for the stimulus-responsive behavior.[3-5] To establish structure–function relationships and demonstrate the versatility of the platform, the SHN were systematically engineered by varying the nature of the core, the silica shell structure (dense or mesoporous), and the polymer composition and architecture (crosslinked network or brush-like structure). This modular approach enables the physicochemical properties and responsiveness of each functional domain to be tailored according to the stimulus to be detected and the requirements of the cargo. Importantly, the use of GRAS (Generally Recognized as Safe) compounds in the synthesis of the SHN, together with their demonstrated cytocompatibility, supports their potential as safe platforms for biomedical applications.

Overall, this rational design strategy provides a versatile framework for developing multifunctional SHN capable of integrating sensing, actuation, and controlled drug release, with significant potential for remotely triggered drug delivery, stimuli-responsive therapeutics, and advanced nanomedicine applications.

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Talk 26 – Shubham Singh

Homologous Tumor-Homing of Cancer Cell-Derived Liposome-Coated Prussian Blue Analogues for Dual-Imaging Guided Photothermal Therapy

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Cancer cell-derived exosomes enable homologous targeting and exhibit significant potential for encapsulating nanoparticles (NPs) bto improve tumor-targeting efficacy. However, their clinical application is constrained by low yield and high isolation costs. In this study, pre-prepared liposome containing 1,2-dioleoyl-sn-glycero-3-phosphoethanolamine was introduced into HepG2 liver cancer cells to facilitate scalable production of cancer cell-derived vesicles, termed membrane-integrated liposomes (H-MIL), through liposome fusion-induced membrane exchange. The Fe_3O_4@SiO_2@PB NPs camouflaged with H-MIL by using sonication. The resulting Fe_3O_4@SiO_2@PB@H-MIL NPs function as both contrast agents for biomedical imaging and photothermal agents for cancer therapy. The MIL, derived from HepG2 cells, enhances the targeting efficacy of Fe_3O_4@SiO_2@PB@H-MIL NPs in HepG2 cells, positioning this NPs as a promising candidate for nanotheranostics in liver cancer. The Fe_3O_4@SiO_2@PB@H-MIL mimics the properties of a natural cell membrane and exhibits prolonged circulation time, thereby increasing NPs delivery to cancer cells. With a photothermal conversion efficiency of 20.2%, this nanoplatform demonstrates strong potential as a photoactivatable material for photothermal therapy. Additionally, the NPs exhibit excellent performance in both photoacoustic and magnetic resonance imaging. This multimodal approach enables dual-imaging-guided therapy. Magnetic targeting further improves the accumulation of NPs at tumor sites. Collectively, these features establish Fe_3O_4@SiO_2@PB@H-MIL NPs as an excellent biomimetic magnetic nanoplatform for targeted cancer therapies, offering an innovative strategy to enhance targeting efficacy and demonstrating potential as a precision nanomedicine for cancer (Figure 1).

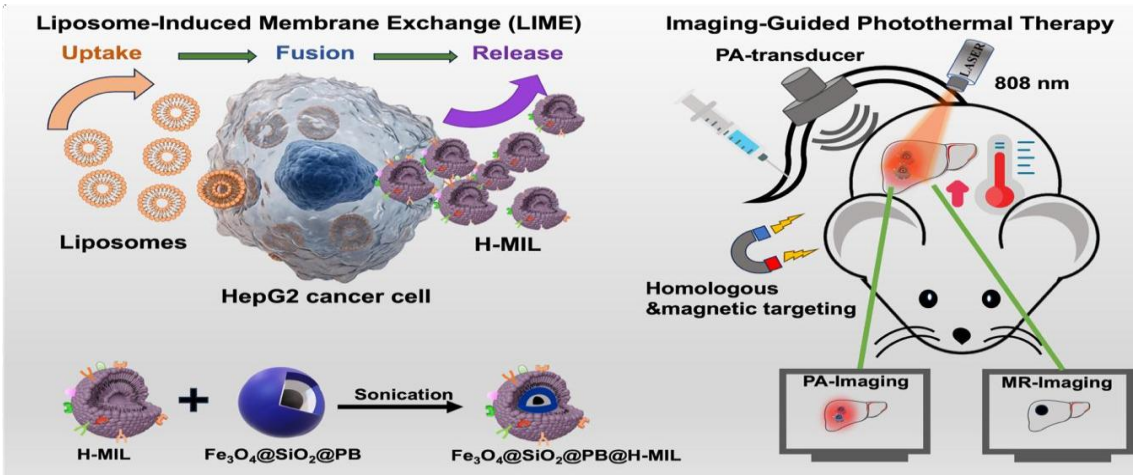

Figure 1. Homologous tumor-homing of cancer cell-derived liposome-coated Prussian blue analogues for dual-imaging guided photothermal therapy.

Posters

Poster	First Name	Last name	Poster title
P1	Ana Teresa	Juárez-Facio	Comparative evaluation of 2D, spheroid, and 3D bioprinted tumor models: toward the development of a PDAC-on-a-chip system
P2	Almar	Al Assaad	An innovative Surface Plasmon Resonance platform for Screening the Targeting Efficiency of Mannose-Functionalised Gold Nanoparticles Towards Lectins
P3	Abiram	Selvaratnam	Mitochondrial delivery of Copper-Elesclomol ionophore derivatives for Multiple Myeloma
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P5	Valarmathi	Mahendran	Challenges of Reproducibility in Nanobioscience - A Replication Study of Nanoparticle-Based Intracellular Sensing
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P7	Eugenia	Barbato	Engineering Prussian blue nanoparticles for cancer therapy
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P9	Héloise	Vincent	Lipid nanoparticles engineered for targeted co-delivery of photosensitizers and siRNA to improve photodynamic therapy of triple-negative breast cancer
P10	Jhon	Miño	Development of a Lipid Nanoparticle-based selective therapeutic approach targeting JAK2V617F in Classical Myeloproliferative Neoplasms
P11	Laraib	Kiran	Towards gold nanoparticle coating: design and synthesis of a functional trivalent organic platform

P12	Mahaut	De Berranger	Development and biological evaluation of inorganic nanoassemblies for theranostic application
P13	Stéphane	Hoang	Hybrid Peptide-Carbon Nanotube Biosensors for Profiling Kinase Biomarkers of Inflammation in Juvenile Arthritis
P14	Thibault	Leray	A novel highly melanoma-specific TCR-T cell product demonstrates safe and enhanced responses against melanoma solid tumors
P15	Tanushree	Gupta	Stealth and pH-Sensing Fluorescent Polymeric Nanoparticles for Bioimaging Applications
P16	Hanif	Afsharara	Can a polymer aid us with pharmaceutical recycling?
P17	Hanif	Afsharara	To stop cancer at it's engine: novel CDK inhibitors
P18	Lionel	Maurizi	Importance of proteins/nanoparticles interactions in the development of in vivo nanomedicine

P1

Comparative evaluation of 2D, spheroid, and 3D bioprinted tumor models: toward the development of a PDAC-on-a-chip system

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Pancreatic ductal adenocarcinoma (PDAC), which accounts for nearly 90% of pancreatic cancers and caused about 500,000 deaths worldwide in 2025, remains among the most lethal malignancies due to its dense stroma and strong chemoresistance [1-3]. Conventional 2D cultures fail to replicate this complex microenvironment, limiting their predictive value for therapy screening [2]. To progressively build a more physiologically relevant *in vitro* system, we compared 2D cocultures, multicellular spheroids, and a 3D bioprinted PDAC construct as sequential steps toward a future organ-on-a-chip platform. In 2D, epithelial tumor cells (PANC-1) and fibroblasts (MeWo) were cultured alone or together to determine doubling time and drug response using WST-1 and Live/Dead assays at increasing gemcitabine concentrations. Spheroids composed of PANC-1, MeWo, or cocultures showed distinct morphological evolution and reduced diameters after 72 h of gemcitabine treatment, as observed by brightfield microscopy. To further enhance structural and cellular complexity, a triculture model combining PANC-1, MeWo, and THP-1-derived macrophages was fabricated via extrusion-based 3D bioprinting in a gelatin–alginate hydrogel. The constructs remained viable for five days, with cell viability decreasing moderately from 73.4% on day 1 to 57.2% on day 5, suggesting active stromal and immune-like interactions. The platform progressively increases complexity, enabling translation to organ-on-chip systems developed in this work. It reduces dependence on 2D cultures and animal models, aligning with regulatory changes toward human-relevant *in vitro* approaches. As an intermediate step, static 3D constructs enable validation before dynamic tumor–stroma integration, establishing a foundation for predictive clinical development of PDAC-on-a-chip.

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P2

An innovative Surface Plasmon Resonance platform for Screening the Targeting Efficiency of Mannose-Functionalised Gold Nanoparticles Towards Lectins

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Gold Nanoparticles (GNPs) represent a versatile platform for theranostic applications, combining imaging and therapy [1], but their clinical potential depends on precise targeting. In inflammatory pathologies, like atherosclerosis, macrophages play a crucial role in plaque vulnerability. Because M2-macrophages selectively overexpress Mannose Receptor (CD206) [2], grafting GNPs with mannose (GNP-Man) moieties is a targeted strategy that will enable receptor-mediated endocytosis, offering a powerful approach for targeted macrophage imaging and selective depletion.

In this study, we developed a novel Surface Plasmon Resonance (SPR) biointerface to assess GNP-Man affinity and specificity against Concanavalin A (Con A), a tetrameric lectin model. The biointerface was engineered on bare gold SPR chips using *in situ* self-assembled monolayer (SAM) formation with TADOTAGA, a thioctic acid derivative containing an endocyclic disulfide bond linked to a DOTAGA macrocycle. Real-time SPR confirmed a reproducible chemical layer, enabling covalent mannose grafting under optimized conditions. Leveraging Con A's tetrameric structure, this yielded a stable, accordable & regenerative platform with remaining free bonding sites for GNP-Man interactions studies.

Five GNP-Man populations (GNP-Man_x, avec x= 10, 20, 50, 100, and 200) were synthesized by varying mannose-to-GNP molar ratios and characterized via TEM, DLS, and UV-Vis spectroscopy. SPR dose-response studies (15–300 µg/mL) with GNP-Man_{10} validated the functionality of the herein architecture, while screening at 30 µg/mL revealed a strong correlation between mannose density and binding signal intensity, with GNP-Man_0 as a negative control.

In summary, this SPR platform using Con A lectin model, enables efficient screening of GNP-Man batches based on mannose coating density. This approach validates a robust framework to select the best GNP-Man candidate for future kinetic profiling and targeting studies on CD206 expressing cells in complex physiological environments.

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P3

Mitochondrial delivery of Copper-Elesclomol ionophore derivatives for Multiple Myeloma

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Elesclomol (ES), an anti-cancer drug, exhibits cytotoxicity via a cuproptosis mechanism that relies on mitochondrial proteins.[1][2] ES is a copper ionophore, a specie capable of chelating copper to form Cu-ES and bring it intra-cellularly (Figure 1, A). Copper is liberated from Cu-ES, by undergoing a reduction from copper (II) to copper (I), by a mitochondrial protein, Ferredoxin 1. The free copper promotes to the aggregation of mitochondrial protein called DLAT, related to oxidative phosphorylation process, in addition to the destabilization of [Fe-S] clusters leading to the cell death. As cuproptosis is highly dependent on mitochondrial proteins, enhancing the accumulation of Cu-ES inside the mitochondria promise improved drug potency, and therapeutic window. As if today, there are currently no Cu-ES derivatives that are targeted to the mitochondria. The project is focused on the development of novel Cu-ES analogues that can target mitochondria (Figure 1, B) to understand the subcellular distribution of the complexes. These analogues are developed by a divergent metallic synthesis, by grafting at the end the key targeting unit. Most mitochondrial targeting unit rely on common physicochemical features including one or more delocalized positive charges combined with significant lipophilicity to promote accumulation into the mitochondria.[3][4] Here we present two series of mitochondria targeted ES derivatives consisting of triphenylphosphonium salt (TPP) and mitochondria penetrating peptide (MPP) units. Actually, the synthesis of a TPP or a MPP Cu-ES derivatives has been conducted, and the in vitro assays are currently ongoing.

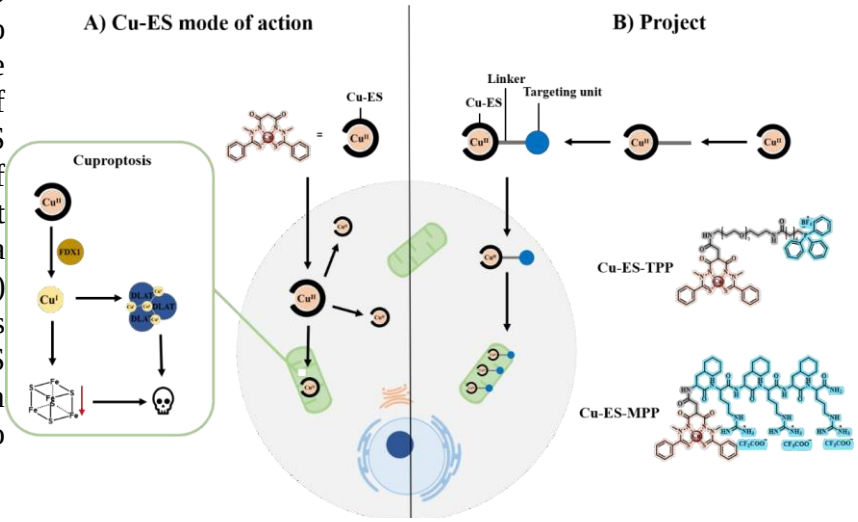

Figure 1. A) Cu-ES mode of action. B) Project design.

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P4

Symbiont-guided, nanoparticle-supported strategies for sustainable plant health and food production

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The increasing number of people affected by food insecurity and malnutrition caused by growth of the world population and climate change is a highly important factor for human health.[1,2] Since the colonization of land, symbionts support plant adaptation to unfavorable environmental conditions.[3] Small, secreted proteins, termed effectors, interact with specific host-target proteins and are essential for the establishment of plant-microbe interaction.[4] However, compared to pathogens, symbiotic effectors are additionally involved in the confer of host benefits such as improved plant development and stress resilience. We revealed that effectors of the beneficial, root colonizing fungus *Serendipita indica* (*Si*) increase plant fitness by modulating hormone signaling and host protein function.[5–7]

To comprehensively investigate *Si* effector (SIEC)-conferred benefits we analyzed specific SIEC-target interactions and the molecular mechanisms of host signaling modulations. Selected effectors and targets revealed specific interaction sites and functional connections, indicating the capacity of SIEC-analyses to support the identification of previously unknown processes for improved plant health. These models can inform breeding and application strategies for the development of crops with enhanced yield and fitness. Application mechanisms can be based on small, complementary peptides (cPEP), which were shown to increase translation of specific plant proteins. cPEPs were shown to improve crop growth and stress resilience.[8,9] An alternative method includes RNA application for the specific regulation of target transcription.[10,11] Symbiont-guided applications can be supported by nanoparticles for enhanced molecule uptake, efficiency and delivery for the development of sustainable plant health and food security.

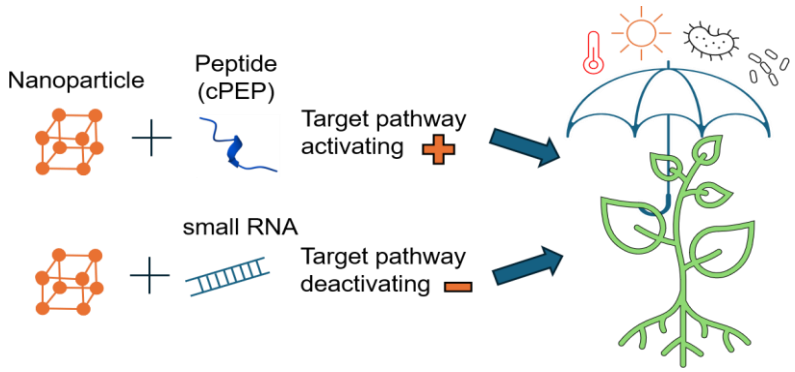

Figure 1. Application strategies for symbiont effector-guided plant protection

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P5

Challenges of Reproducibility in Nanobioscience - A Replication Study of Nanoparticle-Based Intracellular Sensing

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Reproducibility is essential for reliable scientific progress, particularly in nanobioscience, where complex materials, protocols and biological environments can make experiments challenging to reproduce across laboratories. Nanoparticle-based intracellular sensing has attracted considerable interest for its ability to detect biomolecules in living cells, with potential applications in clinical research and nanomedicine. However, in many studies reporting intracellular sensing, endosomal escape of nanoparticles is often assumed rather than experimentally demonstrated.

As part of the NanoBubbles project, we are exploring reproducibility in nanoparticle-based intracellular sensing through the systematic replication of influential studies identified from a curated corpus of highly cited literature on cellular sensing. Our approach combines dialogue with the original authors, preparation of a registered report, laboratory replication of selected experiments, and complementary experiments designed to provide further insights on the intracellular localisation of probes.

Here, we present the replication of two nanoparticle-based sensing platforms: *Nano-Flares: Probes for Transfection and mRNA Detection in Living Cells*, which reported intracellular mRNA detection using oligonucleotide-functionalized gold nanoparticles hybridised with complementary fluorescent labelled strands [1], and *Nanopyramids Self-Assembled from Gold and Upconversion Nanoparticles*, which reported quantitative sensing of microRNA through target-induced structural changes using a dual-modal complementary approach combining circular dichroism and photoluminescence [2].

Across both studies, we document experimental challenges, incomplete protocols, communication with authors, and outcomes. This work does not seek to identify errors in previous research, but to strengthen transparency, identify barriers to reproducibility, and provide practical steps to support more robust and transferable nanoparticle-based biosensing research.

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P6

Self-assembled brush-polymer conjugates for GSPT1 degradation

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Targeted protein degraders (TPDs) are efficient in eliminating disease-driving proteins of interest [1]. Despite their excellent *in vitro* POI-degradability, they are limited by poor pharmacokinetic properties, highlighting the need of tissue targeted TPD systems [2][3]. We have designed an amphiphilic bottlebrush polymer that spontaneously form nanoparticles by simple nanoprecipitation in aqueous media, using a poly-ethylene-glycol-based hydrophilic shell and a hydrophobic core derived either from a GSPT1-targeting degrader (SAGSPT1) or from a control hydrophobic moiety (SA control).

We systematically compared the physicochemical and functional properties of both polymers before and after nanoprecipitation. Atomic force microscopy shows individual bottlebrush chains reorganizing into discrete nanoscale objects upon nanoprecipitation for both SAGSPT1 and the control, while dynamic light scattering confirms the formation of narrowly dispersed particles with hydrodynamic diameters in the optimal range for tumor delivery. Crucially, only the degrader-loaded formulation shows potent, time- and dose-dependent GSPT1 degradation in multiple myeloma cells, with delayed but sustained target depletion compared to free degrader. The control nanoparticles, despite similar size and morphology by AFM and DLS, do not induce GSPT1 degradation, confirming that the biological effect is driven by the degrader payload rather than the polymer architecture alone.

Together, these data demonstrate that the amphiphilic bottlebrush design enables straightforward nanoprecipitation providing a tunable platform to optimize TPD delivery while using appropriate hydrophobic controls to validate specificity.

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P7

Engineering Prussian blue nanoparticles for cancer therapy

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Prussian blue (PB) is one of the earliest known coordination polymers. It was discovered by chance in the early 18th century by the Berlin-based colour-maker Heinrich Diesbach, and its name reflects its geographic origin. Initially used as an inexpensive pigment, it now has a wide range of applications. In particular, advances in nanoscale synthesis over the past two decades have enabled its use in fields from energy storage to biology and medicine.[1] At this scale, PB nanoparticles (NPs) can be described as a metal–organic framework composed of Fe^{3+} and Fe^{2+} ions linked by cyanide ligands, where the nitrogen and carbon atoms coordinate Fe^{3+} and Fe^{2+}, respectively, with an octahedral geometry (figure 1). PB NPs exhibit broad absorption (700-900 nm) in the near-infrared (NIR) region, arising from charge transfer between Fe^{2+} and Fe^{3+}. The relaxation is predominantly thermal, leading to a local temperature increase upon NIR light irradiation.[2] These properties make PB NPs promising agents for photothermal therapy (PTT) in cancer treatment. However, PTT alone is often insufficient for complete tumor eradication and combining it with other approaches can yield synergistic effects. In this context, we aim to optimise PB NP synthesis by exploring different protocols and tuning their size, morphology, and surface functionalisation. Moreover, we seek to couple their photothermal effect with a chemotherapeutic drug to enhance overall therapeutic efficacy. To improve NP loading efficiency, we prepared hollow PB NPs and plan to compare their characteristics with those of the original particles.

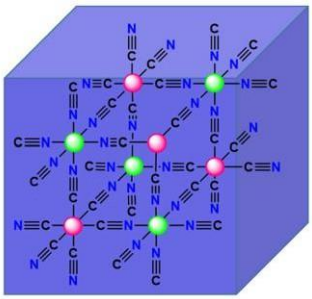

Figure 1: Structure of PB NPs. Fe^{3+} ions are in green, while Fe^{2+} ions are in pink. Image taken from Coll. Surf., B **2023**, *227*, 113373.

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P8

Smart Hybrid Nanosystems for Controlled Release of Docetaxel

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Docetaxel (DOCE) is a widely used taxane chemotherapeutic agent for the treatment of several solid tumors, including breast, prostate, lung, and gastric cancers. Despite its well-established antitumor efficacy, its clinical use is associated with significant systemic adverse effects resulting from its nonspecific distribution, highlighting the need for advanced drug delivery strategies capable of promoting localized drug release at the tumor site.[1,2] In this context, smart polymer-based systems offer a promising alternative due to their ability to undergo controlled transitions in response to environmental stimuli.[3-5] In this work, we propose the design and synthesis of a smart hybrid nanosystem (SHN) platform for the transport and controlled delivery of DOCE. The platform integrates three functional building blocks: a gold nanoparticle core (heat source), a silica shell and a microgel shell composed of N-isopropylacrylamide (NIPA), and 2-hydroxyethyl methacrylate (HEMA), which enables temperature and pH responsiveness.[6] The resulting SHNs were characterized by different techniques which confirmed the formation of the core–shell–polymer architecture, its hydrodynamic size and chemical composition, as well as its responsiveness to both external stimuli (temperature and pH).DOCE-loaded SHNs were evaluated under different external stimuli, including acidic pH, temperature, and light irradiation. The *in situ* release studies revealed that pH was the predominant trigger for DOCE release, whereas the photothermal effect induced by light irradiation resulted in a moderate increase. The biological performance of the platform was subsequently evaluated *in vitro* using the human breast cancer cell line MCF10DCIS.com. Cellular uptake studies were performed to evaluate the internalization of the SHNs, confirming their ability to undergo efficient cellular internalization after 2 h of incubation. The cytocompatibility of the unloaded SHNs was confirmed by MTS and crystal violet assays, showing no intrinsic cytotoxicity and preservation of cell morphology and viability. In contrast, treatment with DOCE-loaded SHNs significantly reduced cell viability to a level comparable to that observed for free DOCE, indicating that drug encapsulation did not compromise its biological activity upon release. Overall, these findings demonstrate the feasibility of the proposed SHNs design and support the ability of DOCE release in the context of a tumoral microenvironment.

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P9

Lipid nanoparticles engineered for targeted co-delivery of photosensitizers and siRNA to improve photodynamic therapy of triple-negative breast cancer

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Triple-negative breast cancer (TNBC) is one of the most aggressive breast cancer subtypes. Due to the absence of estrogen, progesterone and HER2 receptors, treatment options are limited and mainly rely on chemotherapy or radiotherapy. In addition, the hypoxic tumor microenvironment reduces the efficacy of photodynamic therapy (PDT), highlighting the need for new therapeutic strategies.[1]

Lipid nanoparticles (LNPs) are promising nanocarriers for cancer treatment because they can simultaneously deliver different therapeutic molecules while improving their stability and tumor accumulation. In particular, they offer an attractive platform for the co-delivery of photosensitizers and small interfering RNA (siRNA) targeting hypoxia-inducible factor-1 (HIF-1), a key regulator of the hypoxic response.[2]

In this work, we aim to develop multifunctional LNPs combining photodynamic therapy, hypoxia modulation and active targeting of TNBC cells. A targeting peptide recognizing receptors overexpressed on 4T1 cells was synthesized and conjugated to a lipid to allow its incorporation into LNPs.[3] In parallel, photosensitizers were chemically modified with lipid chains to improve their compatibility with the lipid matrix and enhance their incorporation into the nanoparticles. These functionalized building blocks will be combined with HIF-1 siRNA to develop targeted LNPs for improved PDT against hypoxic TNBC tumors. This work provides the basis for the development of multifunctional LNP integrating active targeting, siRNA delivery and PDT. Such nanomedicine-based systems could lead to more selective and effective treatments for aggressive breast cancers.

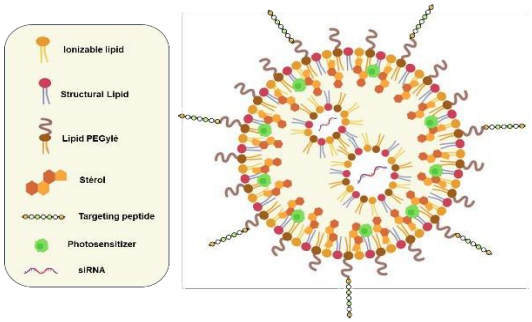

Figure 1. Schematic representation of the multifunctional LNP developed for the co-delivery of a photosensitizer, siRNA and targeting peptide

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P10

Development of a Lipid Nanoparticle-based selective therapeutic approach targeting JAK2V617F in Classical Myeloproliferative Neoplasms

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Classical myeloproliferative neoplasms (MPNs) - polycythemia vera (PV), essential thrombocythemia (ET), and primary myelofibrosis (PMF) - are clonal hematologic malignancies driven by acquired mutations in hematopoietic stem cells (HSCs). The most frequent mutation is JAK2^{V617F}, found in most PV and approximately half of ET and PMF cases. This gain-of-function mutation constitutively activates JAK2 signaling and drives disease development. Current treatments are primarily symptomatic, although IFNα can induce deep responses in a subset of patients. Allogeneic transplantation may be curative in severe disease but is limited by substantial toxicity. [1–2] Thus, there is a major unmet need for targeted, potentially disease-modifying therapies.

We aim to develop a selective JAK2^{V617F}-targeting siRNA delivered by lipid nanoparticles (LNPs) to mutant cells. Our initial formulation, produced via microfluidic techniques, efficiently targeted JAK2^{V617F}-mutant cell lines, achieving >80% inhibition of JAK2^{V617F} expression, oncogenic signaling, and proliferation, with minimal effects on JAK2^{WT} cells. However, delivery and efficacy were less pronounced in primary patient cells.

We therefore optimized our LNP formulations, testing several combinations of helper and ionizable lipids while preserving favorable physicochemical properties, including small size, high siRNA encapsulation, and robust stability. Our optimized LNPs show efficient internalization in cell lines and primary patient cells in vitro. Preliminary qPCR and Western blot analyses demonstrate high selectivity for JAK2^{V617F}, with approximately 40–50% silencing of the mutant transcript in primary cells. Next, we will validate the efficacy on cytokine sensitivity and oncogenic signaling in primary cells, and therapeutic activity in syngeneic and xenogeneic JAK2^{V617F} mouse models.

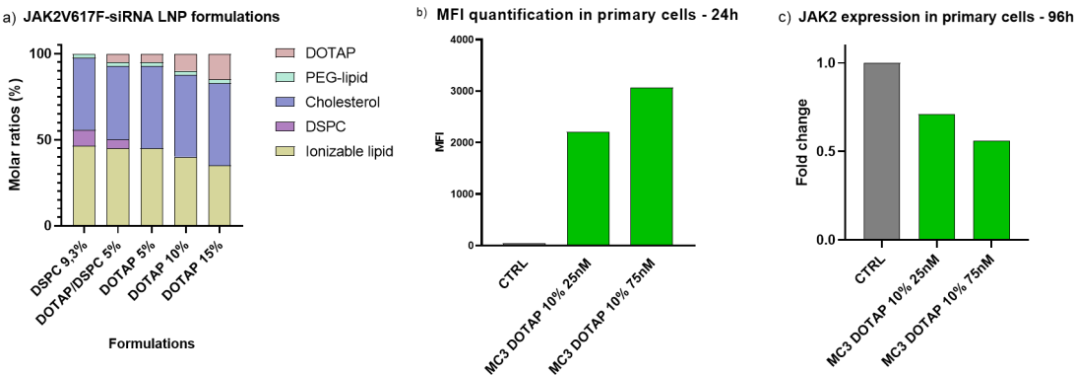

Figure 1. a) Molar ratios of the siRNA-LNP formulations currently in development. b) MFI measurement of LNP internalization by FACS - analysis using 25 or 75 nM siRNA. c) qPCR quantification of JAK2 transcript silencing 96h after treatment using 25 or 75 nM siRNA.

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P11

Towards gold nanoparticle coating: design and synthesis of a functional trivalent organic platform

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Pretargeting is an emerging strategy offering enhanced specificity and reduced systemic toxicity in targeted delivery applications. [1,2] An organic/inorganic nanohybrid theranostic agent made of a gold nanoparticle (inorganic, therapy) and an organic coating made of a radiocomplex (imaging) would need an additional feature, such as a hanging and highly reactive bioorthogonal moiety i.e. tetrazine (Tz) to complete the pretargeting strategy. A synthetic scheme leading to the organic coating will be disclosed, which the nanohybrid is made of and which makes it functional, with respect to both its imaging and targeting features. The scheme will report protection/ deprotection strategies on a multivalent platform aimed at hosting a chelate (the future radiocomplex for imaging), a linker designed to firmly attach the platform onto the gold nanoparticle, and the hanging function of interest (Tz) for the pretargeting strategy. Upon such a platform decoration, its performance will be validated via various control experiments involving successful appending onto the gold nanoparticle, conjugation to Tz, click (IEDDA) reaction, and complexation.

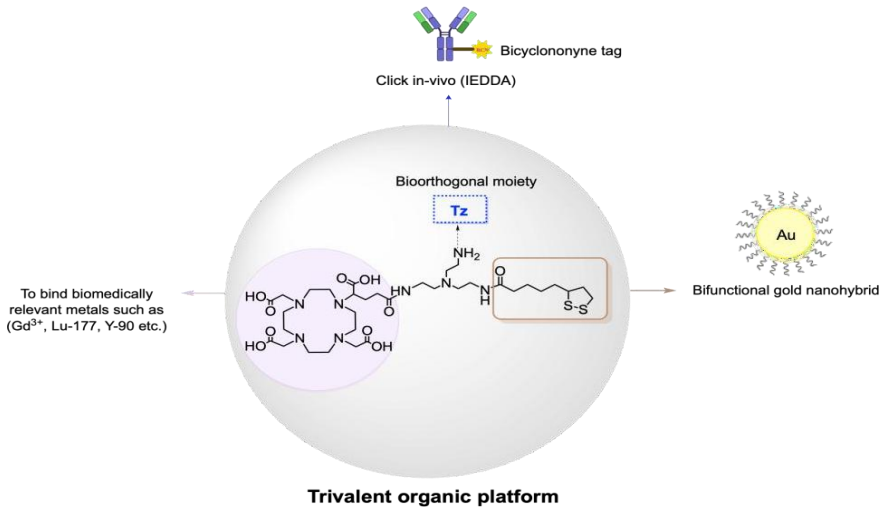

Figure 1: General representation of trivalent organic platform highlighting future applications of each functionality leading towards theranostics

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P12

Development and biological evaluation of inorganic nanoassemblies for theranostic application

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There is a growing need to develop tools to improve diagnosis and treatment efficacy in oncology. Conventional chemotherapies is associated with significant side effects and toxicity. Combining radiotherapy with chemotherapy could represent a promising strategy to treat some resistant tumours, although it requires optimisation of local accumulation of both therapeutic agents and radiation at the tumour site. [1]

In that context, this work aims to develop theranostic nanoassemblies combining mesoporous silica nanoparticles (MSNs) and small gold nanoparticles (AuNPs). MSNs provide drug delivery capability owing to their structural properties and readily functionalisable surface chemistry, while AuNPs exhibit radiosensitising properties, allow the complexation of imaging agents through polydentate ligands, and help ensure the colloidal stability of the nanoassemblies. [2]

Amine-functionalised MSNs were synthesised via a sol-gel route by co-condensation of silanes in the presence of CTAB. [3] Synthesis conditions were optimised to obtain spherical, monodisperse silica nanoparticles, and the reproducibility of the process was quantified across several batches. Colloidal stabilisation strategies, including copolymer or AuNP grafting, were compared by dynamic light scattering in different physiological media, demonstrating the preservation of colloidal stability over several weeks. The internalisation of Rhodamine marked nanoassemblies was assessed by flow cytometry and fluorescence microscopy in several cancer cell lines. A progressive and efficient cellular uptake was observed over 48 h, confirming the ability of the nanoassemblies to accumulate within cancer cells. Moreover, their cytotoxicity was evaluated in the presence of cisplatin. [4]

These findings support the potential of MSNs–AuNPs nanoassemblies as a theranostic platform for the treatment of resistant cancers.

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P13

Hybrid Peptide-Carbon Nanotube Biosensors for Profiling Kinase Biomarkers of Inflammation in Juvenile Arthritis

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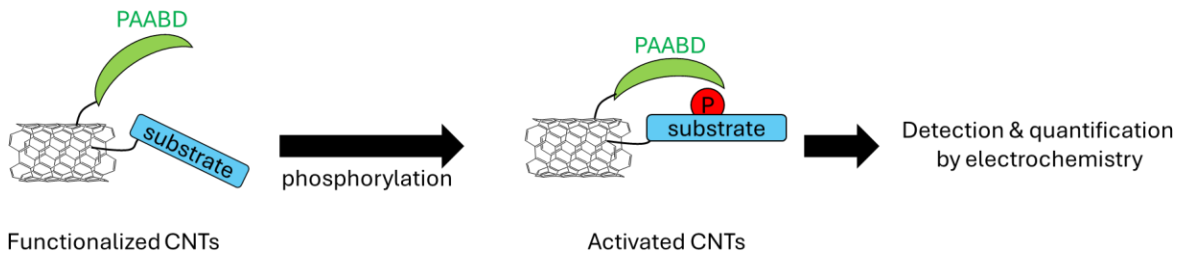
Juvenile arthritis (JA) is a broad term encompassing inflammatory and rheumatic joint diseases that develop during childhood, including septic arthritis (SA) and juvenile idiopathic arthritis (JIA).[1] While both are inflammatory diseases, SA is a bacterial infection and JIA an autoimmune condition. The cause of infection in SA is often undetermined, while the origins and pathophysiology of JIA still remain unknown. Therefore, there is a clear need in establishing an early diagnosis of JA to prevent irreversible damage. Protein kinases (PKs) play key roles in promoting inflammation and immune response. Therefore, they represent promising targets as biomarkers for correlating PKs activities with the early stages of JA. In this matter, developing tailored biosensors to detect and quantify PKs activities is crucial. This project aims to design and synthesize carbon nanotubes (CNTs) functionalized with peptides specific to active PKs associated with JA. To date, the modified CNTs have been prepared through surface functionalization using either a 1,3-dipolar cycloaddition or an amidation reaction, utilizing triethyleneglycol (TEG) derivatives. CNTs functionalized with phosphoamino acid binding domains (PAABD) and its substrate peptide were prepared as proof of concept.[2] During the synthesis, each molecular intermediate was characterized by NMR and MS, while the functionalized CNTs derivatives were systematically analyzed by TGA and the Kaiser test, ensuring the correct loading and successful completion of each reaction. Currently, the different CNTs are being tested by the collaborators in Grenoble using electrochemical methods. Positive results will lead to the evaluation of different peptides specific to JA, previously identified by the biologist collaborators in Montpellier.



Scheme 1. General concept of the functionalized CNTs as biosensors using PAABD and a substrate peptide for the detection and quantification of PKs.

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P14

A novel highly melanoma-specific TCR-T cell product demonstrates safe and enhanced responses against melanoma solid tumors

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Among cellular immunotherapies in the treatment of metastatic melanoma, T-cell Receptor (TCR)-based therapy is one of the most promising. However, two longstanding challenges, both crucial for successful therapy, remain; the selection of a highly tumor-specific antigen and sufficient responses to overcome a complex and immunosuppressive tumor microenvironment. [1] In this study, we focused on a TCR derived from a peripheral blood $CD8^+$ T cell clone from a patient treated with immunotherapy, and specific for MELOE-1, an immunogenic non-conventional melanoma-specific antigen. [2,3]

Primary T cells were retrovirally transduced with natural or murinized versions of this TCR.[4] Results showed that murinization of both α and β-constant domains improved TCR expression (fold change>4). Functional assays demonstrated that improved TCR expression was consistent with increased reactivity against endogenous MELOE-1 antigen in melanoma cell lines and superior cytotoxicity. Our data show that this reactivity of the engineered TCR-T cells persists upon multiple sequential antigen exposure. MELOE-1 TCR-T cells also displayed substantial invasion capacity in 3D models of melanoma compared to non-TCR modified T cells, reinforcing their encouraging therapeutic potential. Additionally, no toxicity against melanocytes from healthy donors was detected, suggesting that our optimized TCR prevails as a melanoma-specific and safe therapy. Finally, TCR-T cell efficacy was assessed *in vivo* in NXG mice injected with melanoma cell lines, and engineered TCR-T cells were able to control tumor growth.

Altogether, these data support the further development of a promising TCR-based T-cell therapy that may be combined with other therapeutic approaches for highly personalized therapies against refractory melanoma.

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P15

Stealth and pH-Sensing Fluorescent Polymeric Nanoparticles for Bioimaging Applications

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Fluorescent polymeric nanoparticles (NPs) offer promising platforms for bioimaging and biosensing, but their application in complex biological environments requires control over non-specific interactions while maintaining their functionality.[1] Dye-loaded polymeric NPs exhibit exceptional brightness due to efficient encapsulation and minimized aggregation-caused quenching of 100-10000 dyes with bulky counterions.[2,3] Herein, we developed poly(ethyl methacrylate-co-methacrylic acid) (PEMA-MA) NPs functionalized with polysarcosine (PSar) of different lengths (5-19mer) via click chemistry.[4] PSar was investigated as a biodegradable, non-toxic and non-immunogenic alternative to PEG for stealth coatings.[5] PSar-NPs showed improved colloidal stability in physiological media as studied by dynamic light scattering (DLS), while fluorescence correlation spectroscopy (FCS) showed a progressive decrease in protein adsorption with increasing PSar chain length. The interaction of PSar-NPs with live cells and glass surfaces in biological media was further studied by epi-fluorescence microscopy, with the 19-mer PSar-NPs demonstrating stealth properties. The developed stealth PSar-NPs was further functionalized with ligands for specific targeting and imaging of proteins of interest within cells as well as with pH-sensitive dyes for FRET-based ratiometric pH sensing. The NPs antenna effect provided a 7-fold amplification of the pH-sensitive dye, enabled monitoring of extracellular pH in living cells and in the presence of proteins and blood serum. Overall, this work demonstrates that relatively short-chain PSar can provide effective stealth properties while preserving NPs functionality, enabling versatile fluorescent nanoplatforms for selective bioimaging and amplified pH sensing in complex biological environments.

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P16

Can a polymer aid us with pharmaceutical recycling?

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Pharmaceutical waste is often treated as an endpoint, even when it may still contain valuable active pharmaceutical ingredients (APIs). Recovering intact APIs from degraded or expired pharmaceutical materials could transform waste from an environmental burden into a source of reusable chemical value. Here, molecularly imprinted polymers (MIPs) were designed and synthesized for selective recovery and purification of norfloxacin, a model fluoroquinolone antibiotic, from a simulated degraded pharmaceutical matrix. Density functional theory (DFT) and frontier molecular orbital (FMO) analyses guided functional monomer selection and molecular recognition-site optimization. Computational evaluation identified a 3:1 methacrylic acid (MAA) to 4-vinylpyridine (4-VP) ratio, crosslinked with ethylene glycol dimethacrylate (EGDMA), as the optimal composition. The optimized MIP demonstrated substantially greater recovery and selectivity than the non-imprinted polymer (NIP). Recovery reached 92.1% at 1 µg/mL, while the MIP consistently outperformed the NIP across 1–100 µg/mL. Its binding capacity was 3.47 µg/mg, compared with 0.51 µg/mg for the NIP, with pronounced selectivity toward structurally related compounds. FTIR and TGA confirmed polymer formation and template removal, while adsorption behavior was best described by the Langmuir model. Overall, these findings demonstrate that computationally engineered MIPs can selectively recover valuable APIs from chemically complex, degraded pharmaceutical materials, highlighting their potential to reduce API waste and support a more circular and resource-efficient pharmaceutical manufacturing model.

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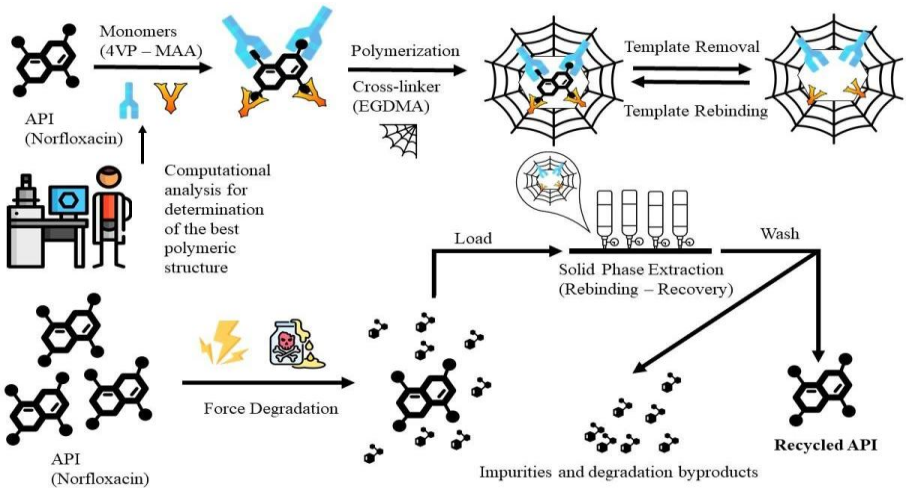

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P17

To stop cancer at it's engine: novel CDK inhibitors

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Introduction: Cancer remains a major global public health challenge and is associated with significant economic, psychological, and physiological burdens. Although chemotherapy remains an important approach for cancer treatment, its clinical application is often limited by adverse drug reactions and unwanted complications. Therefore, the identification of novel molecular targets and the development of more selective antineoplastic agents are essential.
Cyclin-dependent kinases (CDKs) play critical roles in the regulation of the cell cycle and cellular proliferation, and dysregulation of CDK activity is strongly associated with cancer development. Consequently, CDK2, particularly its interaction with Cyclin E1, represents a promising target for anticancer drug discovery. In this study, an integrated computational and experimental approach was employed to design and evaluate potential CDK2/Cyclin E1 inhibitors.

Materials and Methods: Nine compounds were designed and investigated using computational approaches, including molecular docking, molecular dynamics (MD) simulations, pharmacokinetic and drug-likeness prediction, and two-dimensional quantitative structure–activity relationship (2D-QSAR) modeling. Molecular modeling studies were performed using the Maestro molecular modeling platform. The compound showing the most favorable docking performance, compound **4c**, was selected for further investigation and synthesis. Compound 4c was synthesized through a multistep procedure involving the formation of a phthalimide–guanidine core from phthalic anhydride and aminoguanidine, followed by chloroacetylation to generate the chloroacetamide intermediate (b3) and subsequent nucleophilic substitution with 2,6-diaminopyridine. The enzymatic inhibitory activity of compound 4c was evaluated using the luminescent ADP-Glo assay. The IC_{50} value was determined from the dose–response curve, and the apparent inhibition constant (K_i) was calculated accordingly.

Results: Compound 4c demonstrated the most favorable computational profile among the investigated compounds and was therefore selected for experimental evaluation. A 50-ns molecular dynamics simulation indicated stable ligand–receptor interactions and favorable binding within the CDK2 active site, with notable interactions involving **Lys89**. The refined 2D-QSAR model based on the Mol2print method showed excellent statistical performance (**R^2 = 0.9978, Q^2 = 0.9563**). The model predicted an IC_{50} value of **11 µM** for compound 4c, which was in good agreement with the experimentally determined IC_{50} value of **20 µM**. The prediction showed a **1.82-fold deviation (ΔpIC_{50} = 0.26)**, supporting the predictive reliability of the QSAR model. In addition, the predicted pharmacokinetic properties indicated suitable membrane permeability, limited ability to cross the blood–brain barrier, and no predicted classification as a cytochrome P450 inhibitor.

Conclusion: The combined computational and experimental findings identify compound **4c** as a promising CDK2/Cyclin E1 inhibitor candidate. The agreement between the experimentally determined and QSAR-predicted inhibitory activity supports the utility of the developed computational model for predicting CDK2 inhibitor potency. The favorable molecular dynamics and predicted pharmacokinetic profiles further support the potential of this scaffold for future optimization. Additional structural modifications and biological studies are warranted to improve potency and establish the structure–activity relationship of this compound series.

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P18

Importance of proteins/nanoparticles interactions in the development of *in vivo* nanomedicine

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Nanoparticles (NPs) are increasingly being developed for applications in nanomedicine, raising growing concerns regarding their safety and biological efficacy [1]. It is now well established that, upon exposure to biological fluids, NPs rapidly become coated with biomolecules, particularly proteins, forming a layer known as the **protein corona**. While the composition of this corona is largely determined by the physicochemical properties of the NP surface [2], it can in turn profoundly influence their biological identity and *in vivo* fate [3,4].

A better understanding and control of the protein corona are therefore essential to improve the performance of nanomedicines. In this poster we will present:

I. How *in vivo* fate of protein corona formation influence the understanding of bio-circulation of polymer coated superparamagnetic iron oxide nanoparticles (SPIONs in Figure 1).

II. How biological pre-coatings can impact biological fate of SPIONs compared to synthetic coatings

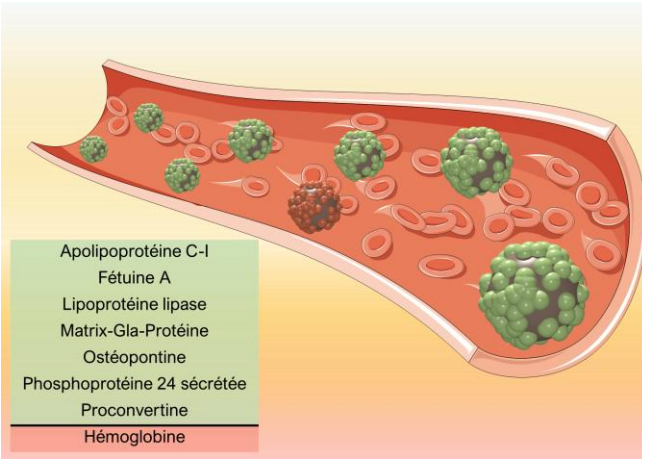

Figure 1. Influence of in vivo protein corona on SPIONs bio-circulations adapted from [4]

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