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Solid State Physics
NanoLund: Center for Nanoscience
Physical Chemistry

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Research

My research is focused on the development of biosensors based on the optical properties of semiconductor nanowires for the detection of biomolecules. These devices could be applied for diagnostics by the detection of biomarkers of disease at early stages and for performing sensitive biological measurements.
In particular, we work with III-V group semiconductor nanowires, such as GaP. Due to their lightguiding properties, they behave like nano-optical fibers and are able to collect and guide the light from close-bound fluorescent molecules. Our aim is to explore and take advantage of these optical properties to build sensitive sensors that enhance the performance and surpass the limit of detection of conventional flat sensing surfaces.
In combination with model membrane systems such as supported lipid bilayers (SLB), it is also possible to create biomimetic systems to study relevant cellular interactions with the enhanced sensitivity offered by nanowires. In order to improve the efficiency of drug-delivery nanocarriers, we emulate and study the interactions between cell membranes and lipid nanoparticles designed for the delivery of mRNA-based drugs. We expect to get a better understanding on the mechanisms responsible of mRNA endosomal escape and thus, improve the efficacy of the treatment.

Qualifications

Advanced Nanoscience and Nanotechnology, MSc, Autonomous University of Barcelona

Biotechnology, BSc, University of Granada

Employment

Doctoral student

Solid State Physics
Lund University
Lund, Sweden
2022 Feb 15 → present

Doctoral student

NanoLund: Centre for Nanoscience
Lund University
Lund, Sweden
2022 Feb 15 → present

Researcher

Physical Chemistry
Lund University
Lund, Sweden
2022 Mar 29 → present

Profile area member

LTH Profile Area: Engineering Health
Lund University

Sweden
2022 Jun 24 → present

Profile area member
LTH Profile Area: Nanoscience and Semiconductor Technology
Lund University
Sweden
2022 Aug 27 → present

Profile area member
LU Profile Area: Light and Materials
Lund University
Sweden
2023 Jan 1 → present

Research outputs

Comparative Kinetics of Supported Lipid Bilayer Formation on Silica Coated Vertically Oriented Highly Curved Nanowires and Planar Silica Surfaces
Valderas-Gutiérrez, J., Davtyan, R., Prinz, C. N., Sparr, E., Jönsson, P., Linke, H. & Höök, F., 2025 Feb 26, In: Nano Letters. 25, 8, p. 3085-3092 8 p.

Image analysis optimization for nanowire-based optical detection of molecules
Davtyan, R., Anttu, N., Valderas-Gutiérrez, J., Höök, F. & Linke, H., 2024, (E-pub ahead of print) In: Nanophotonics.

Sub-Nanomolar Detection of Oligonucleotides Using Molecular Beacons Immobilized on Lightguiding Nanowires
Johansson, T. B., Davtyan, R., Valderas-Gutiérrez, J., Gonzalez Rodriguez, A., Agnarsson, B., Munita, R., Fioretos, T., Lilljebjörn, H., Linke, H., Höök, F. & Prinz, C. N., 2024, In: Nanomaterials. 14, 5, 453.

Enhanced Optical Biosensing by Aerotaxy Ga(As)P Nanowire Platforms Suitable for Scalable Production
Valderas Gutiérrez, J., Davtyan, R., Sivakumar, S., Anttu, N., Li, Y., Flatt, P., Shin, J. Y., Prinz, C., Höök, F., Fioretos, T., Magnusson, M. H. & Linke, H., 2022 Jul 1, In: ACS Applied Nano Materials.

Enhanced human T cell expansion with inverse opal hydrogels†
Santos, F., Valderas Gutiérrez, J., Pérez del Río, E., Castellote-Borrell, M., Rodriguez Rodriguez, X., Veciana, J., Ratera, I. & Guasch, J., 2022 Jun 6, In: Biomaterials Science.

Activities

Nanowire Week 2022 - Oral Presentation on *"Optical biosensing enhanced by aerotaxy nanowires suitable for scalable, low-cost production"*
Valderas Gutiérrez, J. (Speaker)
2022 Apr 25 → 2022 Apr 29

Projects

Development of advanced detection methods for biomolecules on nanostructured surfaces
Valderas Gutiérrez, J. (Research student), Linke, H. (Supervisor) & Höök, F. (Supervisor)
2022/02/15 → …