

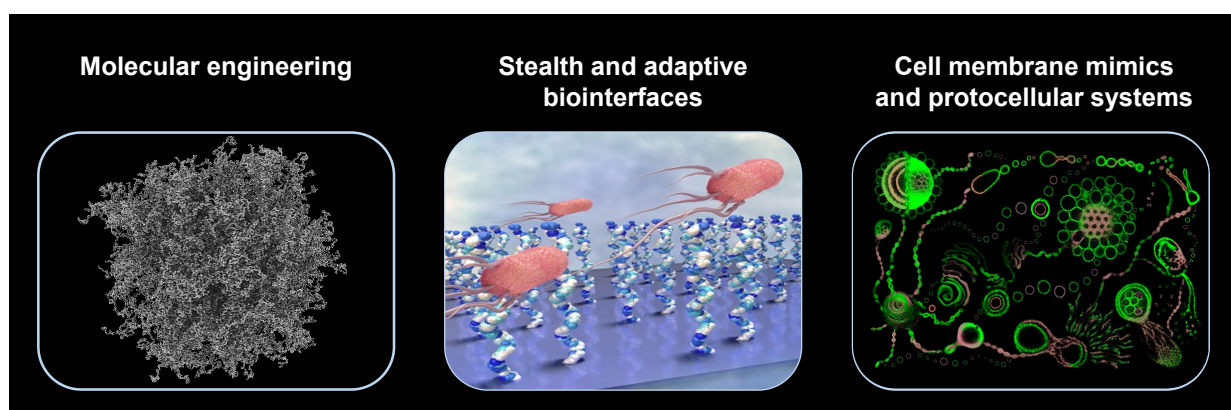
Bio-inspired soft matter at the service of interactive biointerfaces and synthetic cells

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Nature achieves unmatched functionality by the self-assembly of (macro)molecular building blocks in a hierarchical manner. All information necessary for the function is encoded at the molecular level. Unraveling such blueprints serves as a powerful paradigm in the bio-inspired synthesis of materials that can seamlessly interface with living matter or perform non-natural functions. In this talk, I will present a selection of research studies from my lab addressing the overarching task of developing bio-inspired interactive materials and their application in the biomedical field. Three themes will be considered. Firstly, I will present hydrophilic arborescent polymers, a new class of quasi-dendritic macromolecules in which the topology codes for extreme flexibility and enables a myriad of multivalent interactions. Secondly, I will present highlights of the antimicrobial Kill&Repel and Adaptive hemocompatible nanocoatings and our efforts in translating them to medical devices. The last part of the talk will focus on the development of Membrane Machines, tailor-made synthetic vesicles capable of recapitulating some fundamental biological properties and performing specific tasks. We take advantage of these systems to study how biological selectivity can emerge from the lateral organization of ligand in static and dynamic systems such as the bacterial divisome. We are also developing synthetic macrophage-mimetic microrobots capable of endocytosing bacteria and viruses, including SARS-CoV-2.



Research lines of Bioinspired Interactive Materials and Protocellular Systems group.

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Biosketch

César Rodríguez-Emmenegger is a Research Professor at the Institute for Bioengineering of Catalonia (IBEC) and the Catalan Institute for Research and Advanced Studies (ICREA) in Barcelona, Spain. The overarching goal of his research is to uncover design rules to develop materials capable of communicating with living matter—pathogens, cells, tissues—and directing its behavior in a self-regulated manner to enable new biomaterials, therapeutics, and medical devices. He studied Chemical Engineer at Universidad de la República, Uruguay; and a PhD in Biophysics and Macromolecular Chemistry and Physics at the Institute of Macromolecular Chemistry in Prague under the mentorship of Eduard Brynda and Aldo Bologna Alles. Following a postdoctoral research at the group of Prof. C. Barner-Kowollik (Alexander von Humboldt postdoctoral fellowship, 2012-2013), and research stays in Melville Laboratory in Cambridge (Prof. W.T.S. Huck, 2009), University of Pennsylvania (Prof. V. Percec, 2013, 2015) and Pasteur Institute in Lille (Prof. Lafont, 2015), César returned to Prague to start his independent group supported by a Junior Grant from GACR. He was then a Junior Group Leader at DWI-Leibniz Institute for Interactive Materials in Aachen (2016 – 2022) before joining IBEC.