Biological Boundaries: From Receptor-Ligand Interactions to Nanocarrier Surfaces

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Life science can be considered as *the science of boundaries*. It investigates interfaces where living matter meets the physical, chemical or technological world—from the molecular edge where a ligand binds a receptor, to the surface that separates a liposome or lipid-nanoparticle from its biological environment, and onward to the tissue barriers that determine how therapies reach their targets. By probing, characterising and ultimately controlling these boundaries, we turn the complexity of life science into actionable knowledge for health and medicine.

Nanomedicine continually pushes the limits of what can be measured at the interface between biological systems and engineered materials. Exploration at these boundaries is not trivial and often requires methods and techniques that are not easily available in academical labs. We are going to illustrate with a few examples, how our infrastructure contributes with state-of-the-art analytical tools to this field from surface plasmon resonance and analytical ultracentrifugation to TOF-SIMS and XPS. We are going to share also results where collaboration with CERIC partners provided measurement capacities (SAXS) and learning opportunities linked to our projects and helped us to map the interplay between PEGylation, surface charge and opsonisation. We highlight how subtle variations in surface properties dictate cellular uptake, biodistribution and ultimately therapeutic efficacy.

Together, our examples demonstrate that a detailed, multi-modal interrogation of biological boundaries offers a powerful strategy to bridge fundamental biophysics and therapeutical applications. Our talk will conclude with an outlook on how JRC Nanobiotechnology laboratory infrastructure can continue to enable studies that span from material characterisation to nano-bio and *in vitro* cell interactions - research across the life-sciences spectrum within the CERIC network and beyond.

Short bio:

Dora Mehn is scientific research project officer at the Technologies for Health Unit of the European Commission's Joint Research Centre. Since 2014 she works on nanomaterial characterisation using various size separation and analytical methods.

She received her degree as a teacher of Biology and Chemistry in 1997 and her PhD in Environmental Chemistry from the University of Szeged, Hungary in 2002. Before becoming an official of the European Commission, she worked also for biotech industry (Solvo Biotechnology, Hungary) and private health sector (Fondazione Don Gnocchi, Italy). At JRC she contributed to various Outreach projects and leads an exploratory research project related to nanomedicine characterisation. She is also part of the EDQM NANO working group and EC liaison at ISO TC 229.