Nanomedicine Virtual Workshop

AGENDA

Advancing Measurement Technologies and Standards for Nanomedicine

Monday 14th June 2021

Day 1: Application of Nanotechnology

13:00 BST	*Participant log-in*
13:15 BST	*Welcome & introductions from meeting chairs*
13:30 BST	**Marianne Ashford (Keynote)** – Senior Principal Scientist, AstraZeneca *Design and Development of Nanomedicines to Enable Innovative Medicines*
14:00 BST	**Scott McNeil** – Professor, Nano-pharmaceutical & Regulatory Sciences, University of Basel *CQAs: The Link Between Characterisation and Product Quality*
14:25 BST	**Yvonne Perrie** – Professor in Drug Delivery, University of Strathclyde *Delivery Systems for mRNA Vaccines – the Impact of Formulation and Route*
14:50 BST	**Break (15 min)**
15:05 BST	**Chris Tam** – CEO and Co-Founder, Integrated Nanotherapeutics Inc. *Enabling Nanomedicines with Lipophilic Scaffold Technology*
15:30 BST	**Adam Crowe** – Manager, Analytical Development, Precision Nanosystems Inc. *Characterization of Encapsulation, Extraction, and Analysis of mRNA in Lipid Nanoparticles for Drug Delivery*
15:55 BST	**Qin Zou** – Group Leader and Associate Research Fellow, Pfizer *Holistic Characterization of Nanoparticles using Advanced Analytical Tools*
16:20 BST	**Break (10 min)**
16:30 BST	**Panel Discussion: Challenges, opportunities, emerging technologies**

EDT (BST-05:00) / PDT (BST-08:00) / UTC (BST-01:00) / CET (BST+01:00)

Nanomedicine Virtual Workshop

AGENDA

Advancing Measurement Technologies and Standards for Nanomedicine

Tuesday 15th June 2021

Day 2: Regulatory Perspectives

13:00 BST	*Participant log-in*
13:15 BST	*Welcome & introductions from meeting chairs*
13:30 BST	**Anil Patri (Keynote)** – Director, Nanocore, US FDA *Nanomaterial-based Delivery Systems: A Regulatory Science Perspective*
14:00 BST	**Rene Thürmer** – Deputy Head, BfArM Federal Inst for Drugs & Med Device *European Regulatory Considerations on Nano-Enabled Medicinal Products*
14:25 BST	**Xiaoming Xu –** Senior Chemist, Center for Drug Evaluation and Research, US FDA *Supporting the Development of Drug Products Containing Nanomaterials: Guidance, Trends, and Research*
14:50 BST	**Break (15 min)**
15:05 BST	**Kate Arnot –** Director Regulatory CMC, AstraZeneca *Regulatory Challenges in Developing Nanomedicines – An Industry Perspective*
15:30 BST	**Marina Dobrovolskaia** – Director of Operations and the Head of Immunology Section, Nanotechnology Characterization Lab, Frederick National Laboratory for Cancer Research sponsored by the National Cancer Institute *Biomarkers of Nanoparticle Immunotoxicity: Regulatory, Translational and Basic Research Perspective*
15:55 BST	**Break (10 min)**
16:05 BST	**Panel Discussion: Regulation, guidance, best practices, gaps, alignment**

EDT (BST-05:00) / PDT (BST-08:00) / UTC (BST-01:00) / CET (BST+01:00)

Nanomedicine Virtual Workshop

AGENDA

Advancing Measurement Technologies and Standards for Nanomedicine

Wednesday 16th June 2021

Day 3: Standards & Measurement

13:00 BST	*Participant log-in*
13:15 BST	*Welcome & introductions from meeting chairs*
13:30 BST	**Dean Ripple (Keynote)** – Leader, Bioprocess Measurements Group, NIST *Key Drivers for Standardizing Nano-Enabled Medical Products*
14:00 BST	**Jeffrey Clogston –** Principal Scientist and the Head of the Physicochemical Characterization Section, Nanotechnology Characterization Lab, Frederick National Laboratory for Cancer Research sponsored by the National Cancer Institute *Physicochemical Characterization of Lipid-based Delivery Systems: What we know and what we still need to know*
14:25 BST	**Fanny Caputo** – Research Scientist, SINTEF *Measuring Physical Properties of Lipid-based Nanoparticles with Multidetector Asymmetric Flow Field Flow Fractionation: from Method Development to Standardization*
14:50 BST	**Break (15 min)**
15:05 BST	**Dora Mehn** – Project Officer**,** European Commission's Joint Research Centre *Analytical Ultracentrifugation in Nanomedicine Characterization*
15:30 BST	**Shan Zou –** Senior Research Officer, National Research Council Canada *Certified Reference Materials for Lipid-based Nano-delivery Systems – Development and Unique Challenges*
15:55 BST	**Emiliana De Santis** – Senior Research Scientist, National Physical Laboratory *Towards Standardisation of Protein-based Vectors and their Bioactivity*
16:20 BST	**Break (10 min)**
16:30 BST	**Panel Discussion: Measurement methods, measurement technology, reference materials, standards, gaps and challenges**

EDT (BST-05:00) / PDT (BST-08:00) / UTC (BST-01:00) / CET (BST+01:00)

Presentations overview

Presenter:

Marianne Ashford
Senior Principal Scientist

Affiliation

AstraZeneca

Presentation Title and Abstract

Design and Development of nanomedicines to enable innovative medicines

Nanomedicines can address some of the key challenges in Drug Discovery. For small molecule drug discovery; they can enable development of compounds with solubility and lack of therapeutic index; two critical properties for successful development. Nucleic acid based therapeutics have the potential to prosecute many novel targets important for treating diseases yet intracellular delivery is challenging; nanomedicines can deliver drugs intracellularly and thus are important for their exploitation.

This talk with focus on design & development of different nano-based delivery systems; it will discuss the critical factors in the design a nano delivery system for improving therapeutic index and factors important in design of a nano delivery system for intracellular delivery. It will summarise important aspects for successful clinical translation including the importance of understanding the target and disease, the need for robust formulation and manufacturing processes and for advanced analytical characterisation to ensure quality and reproducible in vivo performance.

Background

Dr. Marianne Ashford is a Senior Principal Scientist in a global role in Advanced Drug Delivery Department within Pharmaceutical Sciences at AstraZeneca. Marianne is responsible for applying drug delivery approaches which enable the progression of innovative medicines and is working to enable novel targets through intracellular delivery of new modalities such as nucleic acid-based drugs.

Marianne has been instrumental in introducing nanomedicines to improve therapeutic index into the AstraZeneca Oncology clinical portfolio. She has initiated several collaborations and the building of the internal capability in nanomedicines, drug targeting and intracellular delivery.

Marianne has published over 65 peer reviewed papers and reviews, six book chapters and holds several patents. Marianne holds Honorary Professor roles at the Universities of Nottingham and Manchester and is a Fellow of the Controlled Release Society.

Presenter:

Scott McNeil
Professor of Nanopharmaceutical
and Regulatory Sciences

Affiliation

University of Basel

Presentation Title and Abstract

CQAs: the link between characterisation and product quality

Nanomedicines are now widely approved for human use, against diseases such as cancer, infectious disease, and conditions such as anemia. Compared to a drug's 'legacy' formulation, drug delivery by nanomedicines offers improved pharmacokinetics and safety profiles. We are now also seeing follow-on/generic versions of nanomedicines entering the market, often referred to as 'nanosimilars'. This presentation will discuss the challenges associated with characterising nanomedicines, and comparing follow-on versions with the innovator product. It will address the importance of identifying critical quality attributes for these comparisons, and for regulatory approval. A survey of the current state of the nanomedicine field and its future outlook will also be presented.

Background

Prof. McNeil's research group develops and characterizes novel nano-based formulations, with the goal of improving the therapeutic index of active pharmaceutical ingredients. His current research involves the delivery of therapeutic enzymes for the treatment of lysosomal storage diseases. Within the regulatory sciences field, he identifies and investigates critical quality attributes (CQAs) of nanopharmaceuticals and nanosimilars, such as mechanisms of action, safety, and other regulatory concerns. Prior to joining the University of Basel, Dr. McNeil served for 15 years as the Director of the Nanotechnology Characterization Laboratory, a joint facility of the National Cancer Institute and the US Food and Drug Administration (FDA). He received his B.S. degree in Chemistry from Portland State University, and a Ph.D. in cell biology and anatomy from Oregon Health Sciences University.

Presenter:

Yvonne Perrie
Professor in Drug Delivery

Affiliation

University of Strathclyde

Presentation Title and Abstract

Delivery systems for mRNA Vaccines – the impact of formulation and route

The efficacy of RNA-based vaccines has been recently demonstrated, leading to the use of mRNA-based COVID-19 vaccines. To date, lipid nanoparticles (LNPs) based on ionizable amino-lipids are the most advanced RNA delivery systems and this technology is now being deployed in COVID-19 vaccines. Within our laboratories we have investigated the impact of the delivery system formulation and platform and the route of administration. To achieve this, we investigated the immunogenicity of a self-amplifying mRNA encoding the rabies virus glycoprotein encapsulated in 3 different non-viral delivery platforms (lipid nanoparticles, solid lipid nanoparticles and polymeric nanoparticles). Immunogenicity data in a mouse model showed that lipid nanoparticles and solid lipid nanoparticles induced similar responses and comparable potency with the commercial (non-RNA based) vaccine.

Background

Yvonne Perrie current position is Professor in Drug Delivery within the Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, Scotland. Her research is multi-disciplinary and focuses on the development of drug delivery systems to facilitate the delivery of drugs and vaccines, thus providing practical solutions for current healthcare problems.

Presenter:

Chris Tam
CEO and co-founder

Affiliation

Integrated Nanotherapeutics Inc.

Presentation Title and Abstract

Enabling Nanomedicines with Lipophilic Scaffold Technology

Advances in drug discovery and genomic research have resulted in many promising drugs or bioactive agents with impressive potential in disease treatment. Unfortunately, many of these agents fall short of becoming life-saving therapeutics due to their inherent properties and undesirable side effects, such as the inability to enter disease cells and the interaction with healthy tissues. Our scientific team at Integrated Nanotherapeutics (Vancouver, BC) has developed a lipophilic scaffold platform that solves these issues by transforming difficult molecules into novel nanomedicines. We will discuss the lipophilic scaffold technology for the delivery of various cargos such as small molecules, nucleic acids and peptides.

Background

Dr. Chris Tam, CEO and co-founder of Integrated Nanotherapeutics, obtained her B.Sc. from McGill University and her Ph.D. from the University of Alberta. Prior to founding Integrated Nanotherapeutics, Chris worked at the Life Sciences Institute at the University of British Columbia, where she was part of the supervisory team for graduate and post-graduate scientists working on the development of lipid nanoparticles for the delivery of macromolecule drugs, such as siRNA and DNA, as well as small molecule drugs. Many of these lipid nanoparticle drug formulations have direct implication for the treatment of a wide range of diseases including cancers, hematological diseases, osteoporosis, autoimmune disorders and diabetes.

Presenter:

Adam Crowe
Manager, Analytical Development

Affiliation

Precision Nanosystems Inc. (PNI)

Presentation Title and Abstract

Characterization of Encapsulation, Extraction, and Analysis of mRNA in Lipid Nanoparticles for Drug Delivery

mRNA Lipid Nanoparticle (LNP) vaccines have proven paramount in the fight against COVID-19, however characterization of these therapeutics remains technically challenging due to their complex structure. The mRNA payload is encapsulated within a solid lipid particle suspended in an aqueous vehicle containing a range of stabilizers and excipients. Consequently, mRNA must be extracted from the LNP formulation before being characterized. Moreover, changes in the quantity, purity, or integrity of the mRNA payload must be assessed following the LNP formulation process. Herein, a general guide of methodologies and challenges for the characterization of the mRNA payload, localization with the LNP, and extraction from the LNP is presented. Overall, recommendations for industry-best-practices are discussed.

Background

Dr. Adam Michael Crowe is Manager, Analytical Development at Precision Nanosystems Inc (PNI). Adam Crowe comes with a wealth of bioanalytical experience studying enzymology, mass spectrometry, and metabolomics at the University of British Columbia (UBC). At PNI, Adam manages an analytical team focused on the development of techniques to study all characteristics of mRNA LNPs, with a focus on the mRNA payload and the structural lipids. These expertise have been employed in the development of more than 100 RNA LNP formulations from countless academic or biopharma groups through all stages of the drug development process.

Presenter:

Qin Zou
Group Leader and
Associate Research Fellow

Affiliation

Pfizer

Presentation Title and Abstract

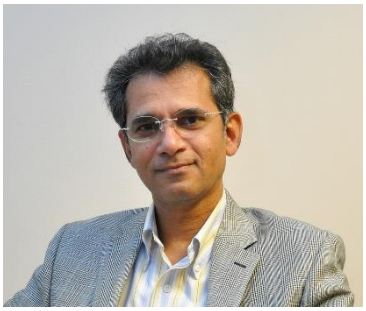
Holistic Characterization of Nanoparticles using Advanced Analytical Tools

Engineered nanoparticles, including lipid-based nanoparticles, have become increasing important in development of medical therapeutics. In-depth understanding of these macromolecular assemblies in terms of their physicochemical properties provides solid foundation for better product quality control. Various advanced analytical techniques will be reviewed and discussed for their application in product characterization, particularly for the intact nanoparticles.

Background

Qin “Chinn” Zou is currently the group leader and associate research fellow at Pfizer Inc., responsible for product and process characterization using various biophysical and biochemical techniques. Before joining Pfizer, he was with Eli Lilly and Co. and worked on formulation development, analytical research and biophysical analysis for biotherapeutics. Qin has a PhD in physical biochemistry from University of Iowa College of Medicine, specifically on thermodynamics of protein stability, protein unfolding and protein interaction. He was also a postdoctoral fellow at Indiana University School of Medicine studying enzymology and protein crystallography.

Presenter:



Anil Patri
Director, Nanocore

Affiliation

US FDA, National Center for Toxicological Research

Presentation Title and Abstract

Nanomaterial-based Delivery Systems: A Regulatory Science Perspective

Standards are an invaluable resource for regulatory agencies and industry. They increase predictability, streamline premarket review, and facilitate market entry of products. Standards development requires maturity of science, expertise & experience, collaborative effort to develop consensus. As nanomaterial containing product submission has grown, FDA increased its participation in collaborative consensus standards development, prioritize based on Agency needs, and assist in their development. The FDA/CDRH recognizes standards that are assessed to be appropriate, and to date 18 nanotechnology standards have been recognized through this program.

This presentation is aimed providing an overview of the current efforts and future standards needs in nanotechnology.

Disclaimer: *The views expressed in this presentation do not necessarily represent those of the U.S. Food and Drug Administration*.

Background

Dr. Anil Patri serves FDA as the Chair, Nanotechnology Task Force, and Director of Nanocore, National Center for Toxicological Research. Nanocore conducts nanotechnology regulatory science research to understand material characteristics, safety, and efficacy through internal research projects in collaboration with product Centers. Nanocore also offers staff training and develops consensus standards through stakeholder collaboration. Dr. Patri serves on the U.S. National Nanotechnology Initiative (NNI) NSET Subcommittee and NEHI working group for US government inter-agency coordination. He is as member of ISO TC229 and ASTM E56 to facilitate standards development.

Presenter:

Dr. René Thürmer
Deputy Head

Affiliation

BfArM (Federal Institute for Drugs and Medical Devices, Bonn, Germany)

Presentation Title and Abstract

European Regulatory Considerations on Nano-Enabled Medicinal Products

The content of the presentation will focus on recent advances in the approval of nanomedicinal products. Current regulatory considerations and requirements for pharmaceutical quality will be highlighted. It will be described how interaction with regulatory agencies early from the beginning may facilitate and promote clinical development programmes.

Background

Dr. René Thürmer received his diploma in chemistry and his Ph.D. in biochemistry from the University of Tübingen. He joined the BfArM (Federal Institute for Drugs and Medical Devices, Bonn, Germany) in 2000. He currently serves as a CMC reviewer and is Deputy Head of the Unit Pharmaceutical Biotechnology.

His experience is in the field of formulation, manufacture and control of medicinal products, in particular in the field of oligonucleotides, peptides, proteins, liposomes, sustained release polymer drug products, depot formulations, polymer-conjugated drug products, natural and synthetic surfactants, nanomedicine and others.

Presenter:

Dr. Xiaoming Xu
Senior Chemist

Affiliation

US FDA, Center for Drug Evaluation and Research

Presentation Title and Abstract

Supporting the Development of Drug Products Containing Nanomaterials: Guidance, Trends, and Research

Nanomaterials can appear in drug products to perform different functions, including serving as active pharmaceutical ingredients (APIs), carriers loaded with an active ingredient, or excipients. The unique properties of nanomaterials, such as small size, large surface area to mass ratio, and variable pharmacokinetic characteristics are useful to overcome some of the limitations commonly found in their larger-scale counterparts. Yet, these very properties that render nanomaterials distinct also make them challenging to control for quality and assess for bioequivalence. In this presentation, some of the common risk factors and quality considerations associated with nanomaterial containing drug products are discussed. Case studies are provided to illustrate the unique challenges associated with the characterization and quality control of nanomaterial drug products.

Background

Dr. Xiaoming Xu is a Senior Chemist in the CDER/OPQ lab. In his role as a Principle Investigator, he leads multiple research areas such as complex ophthalmics, nanomaterials, and advanced manufacturing. He also leads a particle characterization lab in CDER and provides hands-on trainings to reviewers on various topics, including concept of particle size and measurement.

Dr. Xu is a member of the FDA Nanotechnology Task Force and is co-leading the Nanotechnology Reviewer Network. As the FDA representative, Dr. Xu also participates in various international collaborations in areas relating to nanotechnologies, including standard development and International Pharmaceutical Regulator’s Program. Dr. Xu is also an editorial board member of the International Journal of Pharmaceutics.

Presenter:

Dr. Kate Arnot
Regulatory CMC Director

Affiliation

AstraZeneca

Presentation Title and Abstract

Regulatory Challenges in Developing Nanomedicines – An Industry perspective

The content of the presentation will reflect on the experience and learnings, in relation to Quality/CMC, of nanomedicine projects in early phase clinical development.

Background

Kate is an analytical chemist by training with over 25 years' experience in the pharmaceutical industry, initially in analytical development and subsequently in Regulatory Affairs.

Kate is currently a Regulatory CMC Director at AstraZeneca and has been involved in projects at all phases of development from early phase clinical trials to marketing applications in all major territories.

While her experience is primarily with small molecules she has recently been involved in a variety of 'New(er) Modalities' including synthetic peptides, oligonucleotides, and nanomedicines (polymeric nanoparticles and drug dendrimer conjugates).

With an increasing number of projects requiring 'Advanced Drug Delivery' Kate is developing an interest in the registration requirements for novel/non-pharmacopoeial excipients. She has a long-standing interest in impurities and impurity management and is a member of the 'Impurities Advisory Group' within AstraZeneca.

Presenter:

Dr. Marina Dobrovolskaia
Director of Operations and the
Head of Immunology Section

Affiliation

Nanotechnology Characterization Laboratory, Frederick National Laboratory for Cancer Research sponsored by the National Cancer Institute

Presentation Title and Abstract

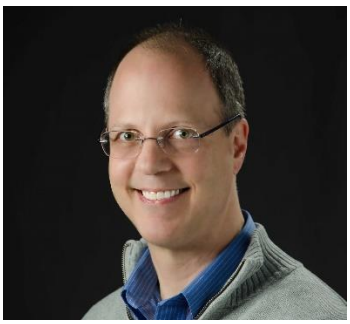
Biomarkers of Nanoparticle Immunotoxicity: Regulatory, Translational and Basic Research Perspective

Despite the sophistication and many therapeutic advantages, the clinical translation of nanotechnology-formulated drug products is often complicated by the immune-mediated toxicities. Cytokine storm, fever-like reactions, and complement activation are among the most common and best-studied acute dose-limiting toxicities. Immunotoxicity due to the alteration in the immune system's function, including but not limited to the immunosuppression and autoimmunity, take longer to develop and are less understood both in terms of the nanoparticle structure-activity relationship and methodologies appropriate for monitoring these toxicities. This presentation will review existing and emerging biomarkers of nanoparticle immunotoxicity, propose experimental strategies for improving our understanding of the immunological safety of nanomedicines and discuss future directions. Case studies of the role of nanoparticle physicochemical properties and their contribution to the immunotoxicity will be used to support the proposed strategy.

Background

Dr. Dobrovolskaia is Laboratory co-Director, Director of Operations and the Head of Immunology Section at the Nanotechnology Characterization Laboratory (NCL). In her role as the Director of Operations, Dr. Dobrovolskaia leads the NCL operations to provide preclinical nanoparticle characterization services to the nanotechnology research community, advance the translation of promising nanotechnology concepts from bench to the clinic, and contribute to the education of the next generation of scientists in the field of preclinical development of nanotechnology-based products, the activities emphasized in the NCL mission. She also directs the performance of Immunology, Client Relations and Administrative sections of the NCL. Closely integrated functioning of these sections plays a critical role in advancing the NCL's key strategic goals, and in supporting the missions of the Frederick National Laboratory for Cancer Research. In her role as the Head of the Immunology Section, Dr. Dobrovolskaia leads a team conducting preclinical studies to monitor nanoparticles' toxicity to the immune system both in vitro and in vivo using variety of immune function animal models. Prior to joining the NCL, Dr. Dobrovolskaia worked as a Research Scientist in a GLP laboratory at PPD Development, Inc. in Richmond, VA, where she was responsible for the design, development and validation of bioanalytical ligand-binding assays to support pharmacokinetic and toxicity studies in a variety of drug development projects. She received her M.S. degree from the Kazan State University in Russia; Ph.D. from the N.N. Blokhin Cancer Research Center of the Russian Academy of Medical Sciences in Moscow, Russia; and MBA from the Hood College in Frederick, MD. Since 2016, she is also a member of the Project Management Institute and a certified Project Management Professional.

Presenter:



Dr. Dean Ripple
Leader, Bioprocess Measurements Group

Affiliation

National Institute of Standards and Technology

Presentation Title and Abstract

Key Drivers for Standardizing Nano-Enabled Medical Products

Nanoparticles of interest for medical purposes are chemically and structurally heterogeneous, are fragile compared to many inorganic nanoparticles, and can interact with other particles or surfaces. These factors can lead to significant measurement challenges. Many of the instruments and methods used for analysis have only recently been applied to these types of materials. I describe some of the phenomena that lead to measurement challenges and outline how reference materials and consensus documentary standards provide complementary tools to overcome these challenges and support reliable analytical measurements.

Background

Dean received a Ph.D. from Cornell University in 1991 and began a post-doctorate position at the National Institute of Standards and Technology the same year. After a successful career at NIST supporting improved methods and standards in thermometry, in 2010 he became Leader of the Bioprocess Measurements Group. His research focuses on the development of new standards for protein particles. Dean has presented workshops on measurement issues to many industrial groups, ranging from petroleum producers to vaccination program coordinators. He is an active member of ASTM and USP committees, and he has received awards from the Department of Commerce, ASME, and ASTM.

Presenter:

Dr. Jeffrey D. Clogston
Principal Scientist

Affiliation

Nanotechnology Characterization Laboratory, Frederick National Laboratory for Cancer Research sponsored by the National Cancer Institute

Presentation Title and Abstract

Physicochemical Characterization of Lipid-based Delivery Systems: What we know and what we still need to know

The National Cancer Institute's (NCI) Nanotechnology Characterization Laboratory (NCL) conducts preclinical characterization including physicochemical (analytical), in vitro, and in vivo of nanoparticles intended as cancer therapeutics and diagnostics. This presentation will highlight the characterization parameters, methods, and considerations related to the physicochemical characterization of lipid-based delivery systems from the testing of more than 450 nanotechnology-based candidate cancer treatments and diagnostics, and are based on the characterization aspects found in the chemistry, manufacturing, and controls (CMC) section in the FDA's industry guidance document for liposome drug products. Furthermore, the current gaps and needs in the physicochemical characterization of lipid-based delivery systems will be discussed.

Funded by NCI Contract No. 75N91019D00024.

Background

Dr. Jeffrey D. Clogston is a Principal Scientist and the Head of the Physicochemical Characterization Section at the Nanotechnology Characterization Laboratory (NCL). In his position, Dr. Clogston conducts physicochemical characterization and standardization of nanoparticles, develops new analytical methodology for critical quality attributes, and assesses current instrumentation for nanoparticle characterization. Prior to joining the NCL in March 2006, Dr. Clogston received his Ph.D. in Chemical Engineering from The Ohio State University. His research dissertation was on the application of the lipidic cubic phase for drug delivery, wastewater remediation, and membrane protein crystallization. His areas of expertise include physicochemical characterization of and in vitro release from lipid-based drug delivery systems, analytical methodology, and protein and lipid biochemistry.

Presenter:

Dr. Fanny Caputo
Research Scientist

Affiliation

SINTEF

Presentation Title and Abstract

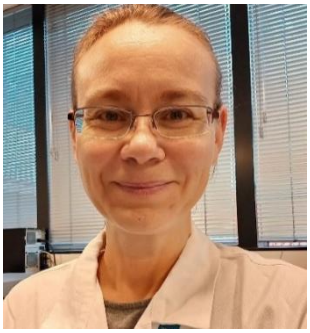
Measuring physical properties of lipid-based nanoparticles with multidetector asymmetric flow field flow fractionation: from method development to standardization

Asymmetric-flow field-flow fractionation (AF4) has been recognized as an invaluable tool for the characterisation of nano-enabled therapeutics and vaccines. To apply MD-AF4 in the pharmaceutical setting, robust and high quality standard operating procedures (SOPs) needs to be developed, tailored on specific sample properties, and according to identifies parameters necessary to validate methods. We will describe how a unique international collaboration led to the development of robust SOPs for the characterisation of liposomal products and lipid-based nanoparticles for RNA delivery (LNP-RNA). Examples of how MD-AF4 methodologies have been validated and used for the analysis of key quality attributes, such as particle size, shape, stability, particle concentration, aggregation and drug loading will be described. MD-AF4 is used as a successful example to describe the pathway from SOPs to standardisation and how the work done on liposomal products can open a fast track for the development of methods for LNP-RNA.

Background

Researcher at SINTEF (Norway) since 2019, Dr Funny Caputo was previously working at CEA (France). Her main interest lies in the physical-chemical assessment of nanomaterials and nanopharmaceuticals for safety and quality assessment and in the standardization of characterization methods for regulatory purposes. She is the chair of the safety and characterization WG of the Nanomedicine European Technology platform and active member of the ASTM E 56 where she is contributing to the first standard test methods on MD-AF4 for testing of liposomal products.

Presenter:



Dr. Dora Mehn
Project Officer

Affiliation

European Commission's Joint Research Centre

Presentation Title and Abstract

Analytical Ultracentrifugation in nanomedicine characterization

Analytical Ultracentrifugation is a classical technique developed for protein molecular mass measurements. In our studies, Analytical Ultracentrifugation (AUC) was applied not only as a confirmatory method for light scattering based ensemble sizing techniques, but as a true orthogonal solution in nanomedicine characterization that uses fundamentally different principles from light scattering for measuring particle size distributions. Moreover, AUC might provide information on homogeneity of very small nanoparticles such as monoclonal antibodies, on antibody-antigen interactions, on particle density (including density of floating particles), and in some cases on drug loading and release in complex medium. The presentation will illustrate the potential of AUC in these applications and highlight the possible benefits of developing validated AUC protocols for medical nanoparticle characterization.

Background

Dr. Dora Mehn is a project officer at the Consumer Products Safety Unit of the European Commission's Joint Research Centre (Ispra, Italy). She earned her degree as a teacher of Biology and Chemisty (1997) and her PhD in Environmental Chemistry (2002) from the University of Szeged (Hungary). After post-doctoral fellowships at the University of Namur (Belgium) and at the University of Szeged (nanoparticle synthesis and characterization) she joined Solvo Biotechnology (Szeged, Hungary, 2005-2008, head of the fee for service screening laboratory). After 3 years at the Joint Research Centre (Ispra, Italy, 2008-2011, grantholder) and 2.5 years at the Fondazione Don Gnocchi (Milan, Italy, researcher) she became an official of the European Commission in 2014. Since then, she has been working on nanoparticle characterization using various separation and size measurement methods and on the extraction and spectroscopic identification of micro- and nanoplastics.

Presenter:

Dr. Shan Zou
Senior Research Officer

Affiliations

Team Leader for the Nanoscale Measurement Disciplines at the Metrology Research Centre of the National Research Council Canada. Adjunct Professor in the Department of Chemistry at the Carleton University.

Presentation Title and Abstract

Certified reference materials for lipid-based nano-delivery systems – development and unique challenges

Through the Innovative Solutions Canada program, the National Research Council of Canada (NRC) and Integrated Nanotherapeutics Inc. (INT) are working together to develop stable drug carrier formulations, in order to support the development of drug product submissions, streamline the regulatory approval process and improve the manufacturability of drug delivery formulations. Six formulations of liposomes and lipid nanoparticles (LNP) using INT's proprietary scaffold lipid technology have been produced with three different sizes and three different surface charges (neutral, positive or negative). The size, polydispersity and zeta potential of each formulation were characterized by dynamic light scattering. Formulations were prepared at a specific concentration in the presence of sucrose for long term storage at -70 °C. Strategies and challenges to improve the stability and reduce the variability of formulations will also be discussed.

Background

Dr. Zou obtained her PhD in studying the supramolecular interactions and stimuli-responsive polymers from the University of Twente, The Netherlands in 2005. After her postdoc work at the University of Toronto, she joined NRC in 2007. Her research focuses on the development of nanoscale measurement methods including the integrated multimodal techniques for characterization of nanomaterials and quantitative detection of cancer cells and cellular mechanical responses to drug treatments. Dr. Zou has expertise in nanomechanics, cytotoxicity measurements of nanomaterials, surface and interface characterizations. She seeks to contribute to a greater understanding of the effects of nanomaterials on the environment and living systems, and to promote the safe and responsible use of nanotechnology tools and nanomaterials. She currently serves as the the Secretary for the ASTM International E56 Nanotechnology Committee (2018-2022) and was the Secretary of the Canadian National Committee for IUPAC (2014-2020). In representing Canada she is also the member of BIPM-CCQM Cell Analysis Working Group.

Presenter:

Dr. Emiliana De Santis
Senior Research Scientist

Affiliation

National Physical Laboratory

Presentation Title and Abstract

Towards standardisation of protein-based vectors and their bioactivity

Viral and non-viral vectors are employed in industry for a broad range of applications, from gene delivery to vaccine development. They hold great promise for the treatment of diseases still untargeted by traditional therapies, as well as the rapid development of vaccines in response to viral pandemics. Despite their potential, complex manufacturing and less advanced standardisation make gene delivery technologies expensive and translation from bench to clinic challenging.

Within this talk, we will review some of our efforts towards the development, characterisation and standardisation of peptide-based vectors in support of gene-delivery and vaccine development and manufacturing.

Background

Dr Emiliana De Santis is Senior Research Scientist at the National Physical Laboratory. She joined NPL in 2013, after obtaining a PhD from the University of Kent and completing a post-doc at Diamond Light Source. Her areas of expertise include molecular biophysics and transmission electron microscopy. At NPL, she is establishing cryo-electron microscopy for the advancement of metrology for advanced therapies. Her research interests include the development of a biophysical/imaging continuum for the characterisation and standardisation of viral and non-viral vectors.