

# PL9006: Key publications on the characterization of vaccines with multi-angle and dynamic light scattering

## Summary

This document lists key publications using multi-angle and dynamic light scattering for the characterization of vaccine agents such as viruses, virus-like particles, mRNA or DNA vectors, polysaccharides, and protein-polysaccharide conjugates.

## Viruses

- Biophysical characterization of influenza virus subpopulations using field flow fractionation and multiangle light scattering: Correlation of particle counts, size distribution and infectivity

Wei Z, Mcevoy M, Razinkov V, et al. *J Virol Methods*. **2007**, *144* (1-2), 122-132.

<http://doi.org/10.1016/J.JVIROMET.2007.04.008>

- Quantitation of influenza virus using field-flow fractionation and multi-angle light scattering for quantifying influenza A particles

Bousse, T. et al., *J. Virological Meth.* **2013** *193*(2), 589-596. <https://doi.org/10.1016/j.jviromet.2013.07.026>

- Formulation and coating of microneedles with inactivated influenza virus to improve vaccine stability and immunogenicity

Kim YC, Quan FS, Compans RW, Kang SM, Prausnitz MR.. *J Control Release*. **2010**, *142* (2), 187-195.

<http://doi.org/10.1016/j.jconrel.2009.10.013>

## Virus-like Particles

- Virus-like Particle Formulation Optimization by Miniaturized High-Throughput Screening

Mohr, J.; Chuan, Y. P.; Wu, Y.; Lua, L. H. L.; Middelberg, A. P. J. *Methods* **2013**, *60* (3), 248–256.

<https://doi.org/10.1016/j.ymeth.2013.04.019>.

- Aggregation and antigenicity of virus like particle in salt solution-A case study with hepatitis B surface antigen

Chen Y, Zhang Y, Quan C, et al. *Vaccine* **2015**, *33* (35), 4300-4306.

<http://doi.org/10.1016/j.vaccine.2015.03.078>

- Asymmetrical flow field-flow fractionation coupled with multi-angle laser light scattering for stability comparison of virus-like particles in different solution environments

Chen Y, Zhang Y, Zhou Y, Luo J, Su Z. *Vaccine* **2016**, *34* (27), 3164-3170.

<http://doi.org/10.1016/j.vaccine.2016.04.046>

- Development of a stable virus-like particle vaccine formulation against chikungunya virus and investigation of the effects of polyanions

Kramer RM, Zeng Y, Sahni N, et al.. *J Pharm Sci.* **2013**, *102* (12), 4305-4314.

<http://doi.org/10.1002/jps.23749>

- A rapid and simple screening method to identify conditions for enhanced stability of modular vaccine candidates

Tekewe A, Connors NK, Sainsbury F, Wibowo N, Lua LHL, Middelberg APJ. *Biochem Eng J.* **2015**, *100*, 50-58. <http://doi.org/10.1016/j.bej.2015.04.004>

- Formulation studies during preclinical development of influenza hemagglutinin and virus-like particle vaccine candidates

Wahome N, Hickey JM, Volkin DB, Middaugh CR.. In: *Methods in Molecular Biology*. Vol 1404. Humana Press Inc.; **2016**, 393-421. [http://doi.org/10.1007/978-1-4939-3389-1\\_27](http://doi.org/10.1007/978-1-4939-3389-1_27)

- Characterization of virus-like particle assembly for DNA delivery using asymmetrical flow field-flow fractionation and light scattering

Citkowicz, A. and Petry, H. *Anal. Biochem.* **376**, 163-172 (2008). <https://doi.org/10.1016/j.ab.2008.02.011>

- Quantitative analysis of virus-like particle size and distribution by field-flow fractionation

Chuan, Y.P. et al., *Biotechnology and Bioengineering* **99**(6) 1425-1433 (2008). <https://doi.org/10.1002/bit.21710>

- Quantitative characterization of virus-like particles by asymmetrical flow field flow fractionation, electrospray differential mobility analysis, and transmission electron microscopy

Pease, L.F. et al., *Biotechnology and Bioengineering* **102**(3) 845-855 (2009). <https://doi.org/10.1002/bit.22085>

#### RNA/DNA vectors

- Advanced nanomedicine characterization by DLS and AF4-UV-MALS: Application to a HIV nanovaccine

Klein M, Menta M, Dacoba TG, et al. *J Pharm Biomed Anal.* **2020**, *179*, 113017. <http://doi.org/10.1016/j.jpba.2019.113017>

#### Nanoparticles

- Measuring particle size distribution by asymmetric flow field flow fractionation: a powerful method for the preclinical characterization of lipid-based nanoparticles

Caputo, F. et al., *Mol. Pharm.* **16** (2), 756-767 (2019). <https://doi.org/10.1021/acs.molpharmaceut.8b01033>

- Advanced nanomedicine characterization by DLS and AF4-UV-MALS: Application to a HIV nanovaccine

Klein. M. et al., *Pharm. Biomed. Anal.* **179**, 113017 (2020). <https://doi.org/10.1016/j.jpba.2019.113017>

#### Polysaccharides

- Alignment of Absolute and Relative Molecular Size Specifications for a Polyvalent Pneumococcal Polysaccharide Vaccine (PNEUMOVAX®23)

MacNair, J. E.; Desai, T.; Teyral, J.; Abeygunawardana, C.; Hennessey, J. P. *Biologicals* **2005**, *33* (1), 49-58. <https://doi.org/10.1016/j.biologicals.2004.11.002>

- Stabilization study of inactivated foot and mouth disease virus vaccine by size-exclusion HPLC and differential scanning calorimetry

Yang Y, Zhao Q, Li Z, et al. *Vaccine*, **2017**, *35* (18), 2413-2419. <http://doi.org/10.1016/j.vaccine.2017.03.037>

#### Protein-polysaccharide conjugates

- Structural Correlates of Carrier Protein Recognition in Tetanus Toxoid-Conjugated Bacterial Polysaccharide Vaccines

Lockyer, K.; Gao, F.; Derrick, J. P.; Bolgiano, B. *Vaccine* **2015**, *33* (11), 1345-1352. <https://doi.org/10.1016/j.vaccine.2015.01.046>

- Evaluation of meningococcal C oligosaccharide conjugate vaccines by size-exclusion chromatography/multi-angle laser light scattering

Jumel K, Ho MM, Bolgiano B. *Biotechnol Appl Biochem.* **2002**, 36 (3), 219.  
<http://doi.org/10.1042/ba20020066>

- Higher mass meningococcal group C-tetanus toxoid vaccines conjugated with carbodiimide correlate with greater immunogenicity

Lockyer K, Gao F, Francis RJ, et al. *Vaccine.* **2020**, 38 (13), 2859-2869. <https://doi.org/10.1016/j.vaccine.2020.02.012>

- Structural organization of NadAΔ351-405, a recombinant MenB vaccine component, by its physico-chemical characterization at drug substance level

Magagnoli C, Bardotti A, De Conciliis G, et al.. *Vaccine.* **2009**, 27 (15), 2156-2170.  
<http://doi.org/10.1016/j.vaccine.2009.01.099>

- Novel configurations of high molecular weight species of the pertussis toxin vaccine component

Fowler S, Byron O, Jumel K, Xing D, Corbel MJ, Bolgiano B. *Vaccine* **2003**, 21 (19-20), 2678-2688.  
[http://doi.org/10.1016/S0264-410X\(03\)00105-1](http://doi.org/10.1016/S0264-410X(03)00105-1)

#### Antigen proteins

- Utilizing Dynamic Light Scattering as a Process Analytical Technology for Protein Folding and Aggregation Monitoring in Vaccine Manufacturing

Yu, Z.; Reid, J. C.; Yang, Y.-P. *J Pharm Sci* **2013**, 102 (12), 4284-4290. <https://doi.org/10.1002/jps.23746>.

- Evaluation of on-line high-performance size-exclusion chromatography, differential refractometry, and multi-angle laser light scattering analysis for the monitoring of the oligomeric state of human immunodeficiency virus vaccine protein antigen

Barackman, J., Prado, I., Karunatilake, C. & Furuya, K. *J. Chromatogr. A* **2004**, 1043 (1), 57-64.  
<https://doi.org/10.1016/j.chroma.2004.02.011>

- Improved stability of a protein vaccine through elimination of a partially unfolded state

McHugh CA, Tammariello RF, Millard CB, Carra JH. *Protein Sci.* **2009**, 13 (10), 2736-2743.  
<http://doi.org/10.1110/ps.04897904>

- Structure of the influenza virus A H5N1 nucleoprotein: implications for RNA binding, oligomerization, and vaccine design

Ng AK, Zhang H, Tan K, et al. *FASEB J.* **2008**, 22 (10), 3638-3647. <https://doi.org/10.1096/fj.08-112110>

#### Peptides

- Chromatographic characterization of synthetic peptides: SPf66 malaria vaccine

Santoveña A, Oliva A, Guzman F, Patarroyo ME, Llabrés M, Fariña JB. *J Chromatogr B Anal Technol Biomed Life Sci.* **2002**, 766 (1), 3-12.  
[http://doi.org/10.1016/S0378-4347\(01\)00392-9](http://doi.org/10.1016/S0378-4347(01)00392-9)



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