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Lecture Series: Designing ionizable lipids and lipid nanoparticles for mRNA vaccines

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Contact Person: Nicole Tenly
Host: Tom Cleveland

Event Info

Date: May 24 2021 - 11:00am to 12:00pm
Location: Virtual

Details

Speaker/Presenter: Professor Michael Buschmann
Speaker Affiliation: George Mason University
Event Description:
TITLE: Designing ionizable lipids and lipid nanoparticles for mRNA vaccines

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ABSTRACT: Covid-19 mRNA vaccines are mainly composed of lipids (95% w/w) to effectively deliver the mRNA payload (5% w/w) that is translated intracellularly at the injection site and in the draining lymph nodes to stimulate the immune system to mount a humeral response to the protein immunogen. The key component of the lipid nanoparticle (LNP) delivery system is an ionizable lipid that binds the mRNA during assembly of the mRNA LNP and effectively releases it intracellularly when triggered by endosomal protonation. The success of mRNA vaccines are due in large part to their efficient delivery by the ionizable lipid and the immune adjuvant properties of the ionizable lipid. We have developed a novel rational approach to design more effective ionizable lipids starting with a theoretical assessment of their ionization properties that effect endosomal release. The resulting ionization properties are then assessed molecularly as well as in the colloidal state of the LNP and related to delivery efficiency in vitro and in vivo. In parallel we assess local inflammatory reactions and non-frozen storage properties to ensure translatability to human clinical trials. This systematic approach has resulted in a number of novel LNPs that exhibit greater potency than the current reference LNPs including their ability to protect against a lethal viral challenge in an animal model.

BIO: Michael Buschmann is the Chair of Bioengineering at George Mason University since 2017. He was previously Professor of Biomedical Engineering and Chemical Engineering at Polytechnique de Montréal from 1994 to 2017 where his biomaterials research resulted in successful clinical translation of a cartilage repair product and new nanovectors for the delivery of nucleic acids. He is currently focusing on ionizable lipids to deliver messenger RNA for vaccines.

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