

# Toward predictable mRNA–lipid nanoparticle delivery: lessons from human blood kinetics of mRNA vaccines

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## Abstract

Characterising how mRNA vaccine components behave in human blood offers a practical window into the in vivo kinetics of mRNA–lipid nanoparticles (LNPs). We have previously shown that both vaccine mRNA and ionizable lipids can be quantified in serial blood samples for weeks after vaccination.<sup>1</sup> We discovered PEG immunogenicity of SARS-CoV-2 mRNA–LNP vaccines in a clinical study.<sup>2</sup> These antibodies may alter the biodistribution of subsequent PEG-containing nanomedicines. Our recent studies have further explored links between PEG-specific antibodies and mRNA vaccine circulation in human blood<sup>1</sup> and demonstrated how anti-PEG antibodies can influence patient-specific nanoparticle targeting in blood in the context of cancer.<sup>3</sup>

In this talk, I will provide our perspectives on these studies,<sup>4,5</sup> and introduce our recent clinical study comparing the blood kinetics of three mRNA vaccine platforms used in humans. This work establishes a quantitative framework to benchmark mRNA–LNP pharmacokinetics and transcript integrity directly in human blood.

## References

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