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(G*) Erythro-VLPS: Embedding SARS-COV-2 Spike Proteins in Red Blood Cell Based Proteoliposomes Leads to Pronounced Antibody Response

Tuesday 8 June 2021 12:00 (5 minutes)

Novel therapeutic strategies are urgently needed to control the SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) pandemic. This virus belongs to a larger class of corona viruses currently circulating, which pose major threats to global public health. Here, I present the fabrication and characterization of Erythro-VLPs: Erythrocyte-Based Virus Like Particles, i.e., red blood cell based proteoliposomes carrying the SARS-CoV-2 spike protein.

Erythrocytes can present antigens to the immune system when senescent cells are being phagocytized in the spleen. This capacity together with their high biocompatibility make red blood cells (RBCs) effective vehicles for the presentation of viral immunopathogens, such as the SARS-CoV-2 S-protein, to the immune system. .The proteoliposomes were prepared by tuning lipidomics and proteomics of the RBC membranes on a nanoscale. Epi-fluorescent and confocal microscopy, dynamic light scattering (DLS), and Molecular Dynamics (MD) simulations were used to characterize the liposomes and the insertion of the S-proteins. The protein density on the outer membrane was estimated to be 70 proteins/μm. The Erythro-VLPs have a well-defined size distribution of 222±6 nm and exhibit dose-dependent binding to ACE-2 (angiotensin converting enzyme 2) in biolayer interferometry assays.

We present direct experimental evidence of a pronounced immunological response in mice after 14 days, after two injections, and the production of antibodies was confirmed in ELISA. In addition, these antibodies were found to be specific for the S-protein RBD sub-domain demonstrating that the protein not hidden or conformationally altered by the developed protocol. This immunological response was observed in the absence of any adjuvant which is usually required for protein-based vaccines.

The RBC platform that we present in this work can easily and rapidly be adapted to different viruses in the future by embedding the corresponding antigenic proteins and opens novel possibilities for therapeutics.

[1] Himbert et al., "Erythro-VLPs: Embedding SARS-CoV-2 spike proteins in red blood cell based proteoliposomes leads to pronounced antibody response in mouse models", submitted.

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