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Engineering Ferritin-Based Nanoparticles for Enhanced Immunogenicity Against SARS-CoV-2

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Ferritin nanoparticles have emerged as crucial components in new recombinant vaccine platforms. As we previously demonstrated in our previous works, the rational design of ferritin-immunogen nanoparticles remains a bottleneck in developing novel tools for drug delivery and immunology [1], [2]. This challenge arises from the stochastic nature of ferritin's self-assembly, which also affects chimeric ferritin-based protein complexes. Consequently, the assembly process can yield nanoparticles with varying stoichiometries, complicating the design of uniform and effective immunogens.
In this study, we engineered several ferritin-immunogen nanoparticles and evaluated their immunogenicity in laboratory mice by measuring antibody titers against the receptor-binding domain (RBD) of the SARS-CoV-2 spike protein. We assessed different nanoparticle variants, including those with varying stoichiometries. The globular assembly of these nanoparticles was confirmed using small-angle scattering and electron microscopy. Our findings provide valuable insights into the structure-based design of ferritin-based immunogens and offer a deeper understanding of the molecular mechanisms underlying their efficacy.
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Literature
[1] V. V. Sudarev et al., "Ferritin self-assembly, structure, function, and biotechnological applications,"Int J Biol Macromol, vol. 224, pp. 319–343, Jan. 2023, doi: 10.1016/J.IJBIOMAC.2022.10.126.
[2] V. V. Sudarev et al., "Ferritin-based fusion protein shows octameric deadlock state of self-assembly," Biochem Biophys Res Commun, vol. 690, p. 149276, Jan. 2024, doi: 10.1016/J.BBRC.2023.149276.

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