Multivalent display technologies on protein nanoparticle surfaces: Design, construction and evaluation

Ferritin, due to its unique structure and physicochemical properties, has been designed for protein display and applied in fields such as tumor-targeted drug delivery and vaccine research. As an excellent protein display carrier, ferritin possesses several advantageous characteristics. Our group first selected protein groups with varying structural complexity, including FGG, RGD, CiA, Nluc, and GST, for display on the surface of ferritin. This demonstrated that ferritin, as a multivalent nanoparticle display platform, can present relatively complex proteins.

We then selected RGD, which can selectively bind to integrin αvβ3 upregulated on the surface of rapidly dividing cells, along with the RBD from the SARS-CoV-2 surface, to explore the feasibility of ferritin as a multivalent nanoparticle display platform from both tumor immunity and infection immunity perspectives. The experiment successfully displayed RBD and RGD on the surface of ferritin. However, the ferritin subunits expressing RBD were insoluble. We attempted to resolve this by reducing structural complexity and adjusting the protein display ratio, but the resulting protein remained insoluble.

In subsequent work, we will make further adjustments to the ratio and investigate whether inclusion bodies have formed. Additionally, we successfully expressed and obtained soluble RGD-FTn, improving its solubility by adjusting the RGD expression ratio and conducting a preliminary assessment of its efficacy. This validated that functional optimization of ferritin protein display can be achieved through protein modulation.