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747 **Supplemental Figure legends:**

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750 **Figure S1. Structural and biophysical characterization of the trivalent SARS-CoV-**

751 **2/SHC014/MERS RBD scNP. (A)** Analytical size exclusion chromatography with a Superose6

752 column showing a homogenous protein nanoparticle at the expected elution volume. **(B)**

753 Negative stain electron microscopy of trivalent RBD scNP. 2D class average is shown on the

754 bottom left and a raw image of a single nanoparticle is shown on the top left. The raw image of
755 the carbon grid is shown on the right. **(C and D)** Differential scanning fluorimetry of the
756 individual components and assembled trivalent RBD scNP. Melting temperature is defined as the
757 inflection temperature (T_i) on the 350 nm/330 nm ratio curve.

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759 **Figure S2. Protective efficacy of monovalent vs trivalent RBD scNP vaccines against**
760 **MERS-CoV challenge in 2X vaccinated mice.** **(A)** Weight loss following MERS-CoV
761 intranasal challenge in monovalent, trivalent, and adjuvant-only vaccinated mice. **(B)** Infectious
762 virus replication in the lung at day 2 post infection. **(C)** Infectious virus replication at day 2 post
763 infection in nasal turbinates. **(D)** Infectious virus replication at day 4 post infection. A Kruskal-
764 Wallis test with a Dunn's multiple comparison correction test was used for calculating statistical
765 significance in all panels. * $P < 0.05$, ** $P < 0.005$, *** $P < 0.0005$, and **** $P < 0.0001$

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767 **Figure S3. Immunogenicity of monovalent vs trivalent RBD scNP vaccines in 2X vs 3X**
768 **vaccinated mice.** **(A)** vaccination schema with monovalent scNP, trivalent scNP, and adjuvant
769 only (GLA-SE). **(B)** LogAUC IgG binding comparison of 2X (prime-boost) vs 3X (prime-boost-
770 boost) vaccinated mice with monovalent, trivalent, and adjuvant-only against genetically
771 divergent RBDs from Group 1 (canineCoV-HuPn). Group 2a (OC43), Group 2b (WIV-1, GZ02,
772 ZC45, GXP4L, and BANAL-236), Group 2c (MERS-CoV, NL140422, HKU4, and HKU5),
773 Group 2d (BtKY06), and Group 4 (Porcine deltacoronavirus Haiti).

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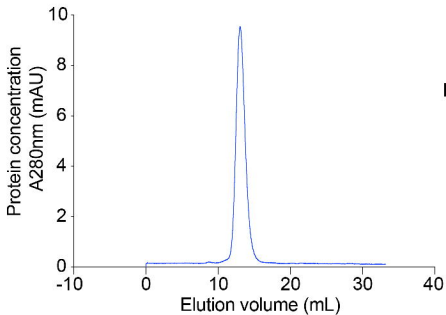
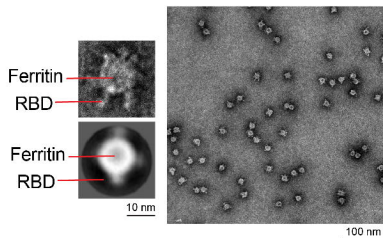
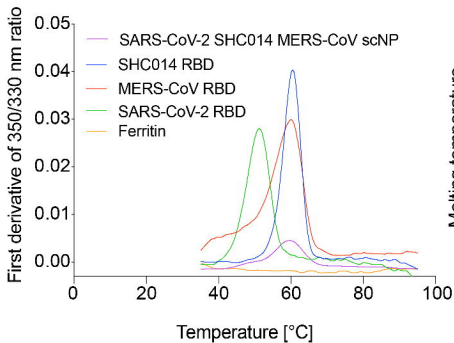
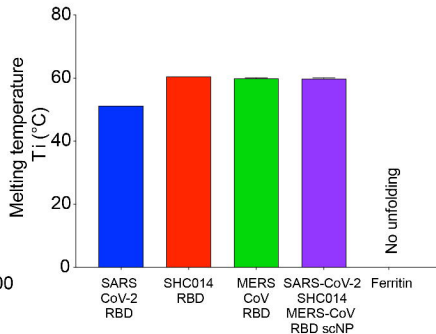
Figure S1**A****B****C****D**

Figure S2

MERS-CoV challenge

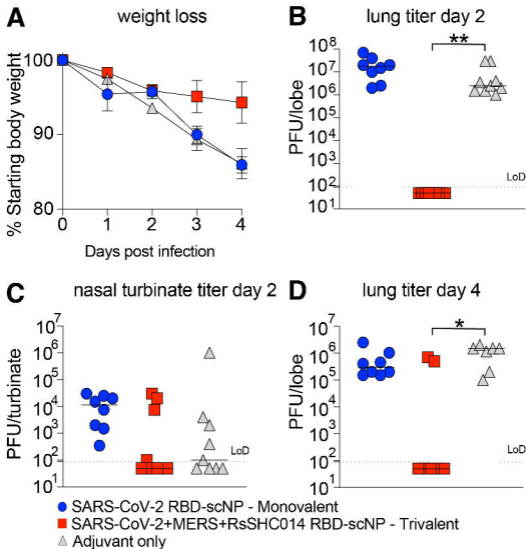
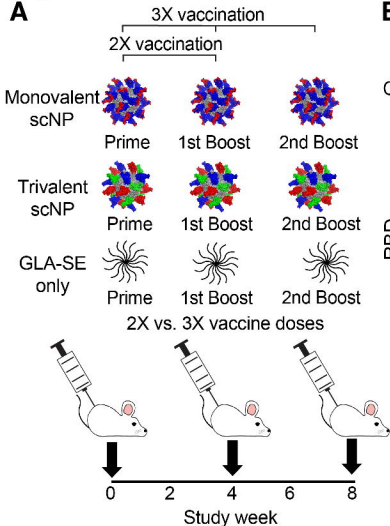


Figure S3**A****B**