

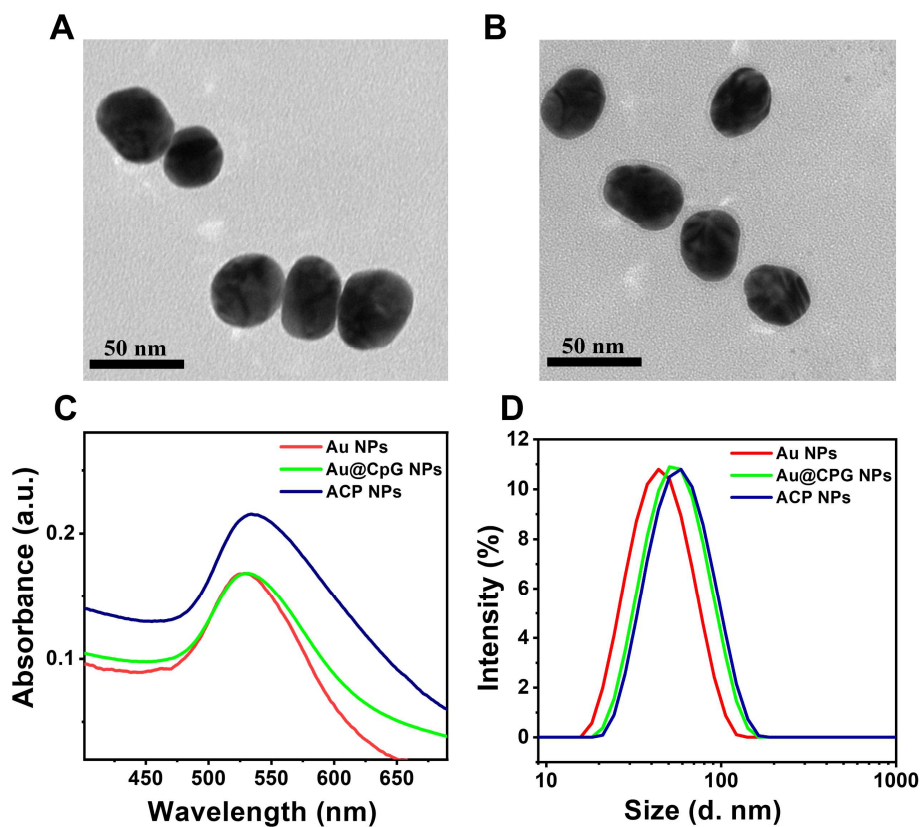
## Supporting Information

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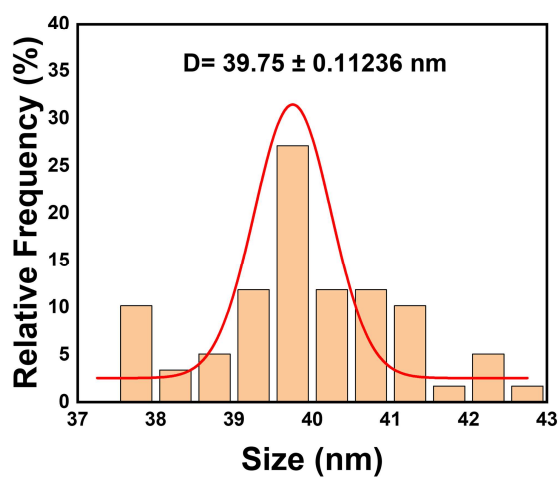
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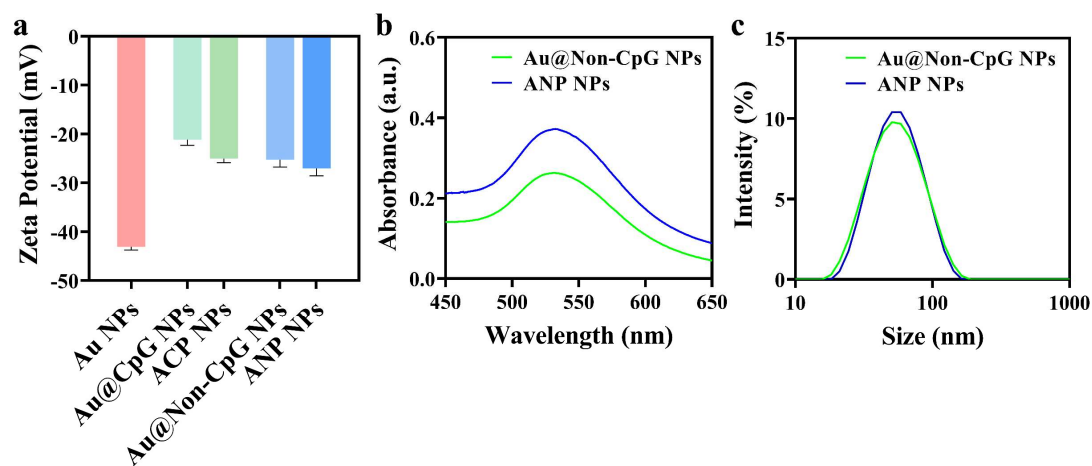
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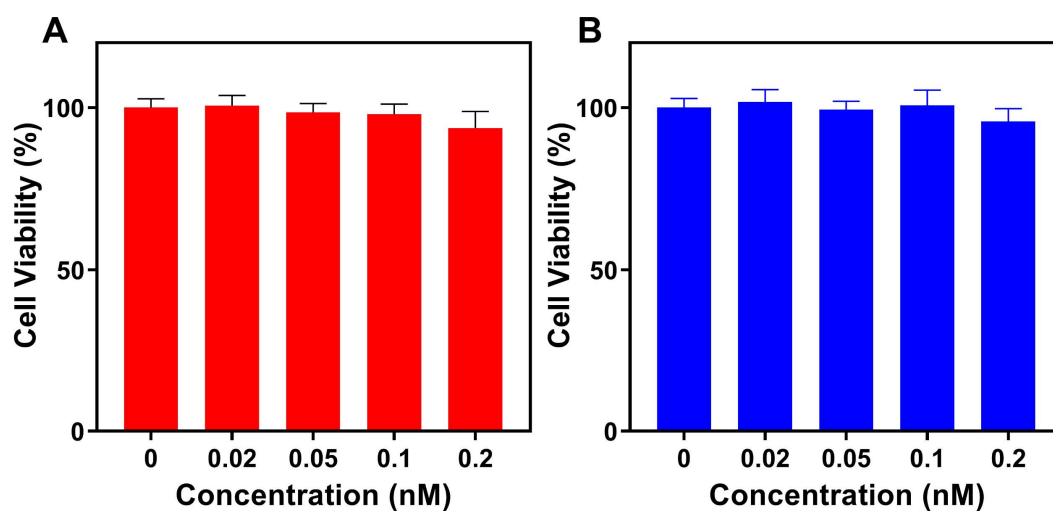
**Figure S1.** Characterization of the prepared nanoparticles. TEM images of Au NPs (A) and Au@CpG NPs (B). (C) UV-vis absorption spectra of Au NPs, Au@CpG NPs and ACP NPs. (D) Hydraulic diameters of the prepared nanoparticles.



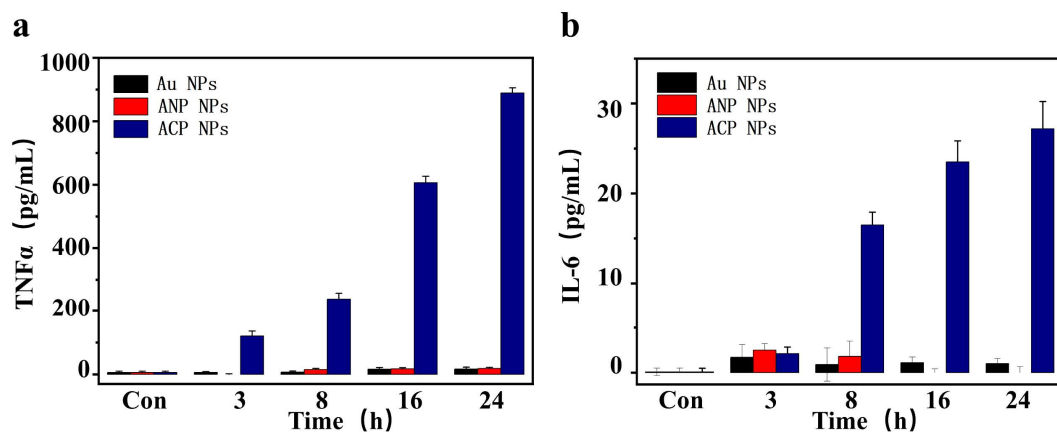
**Figure S2.** The size distribution histogram of Au NPs.



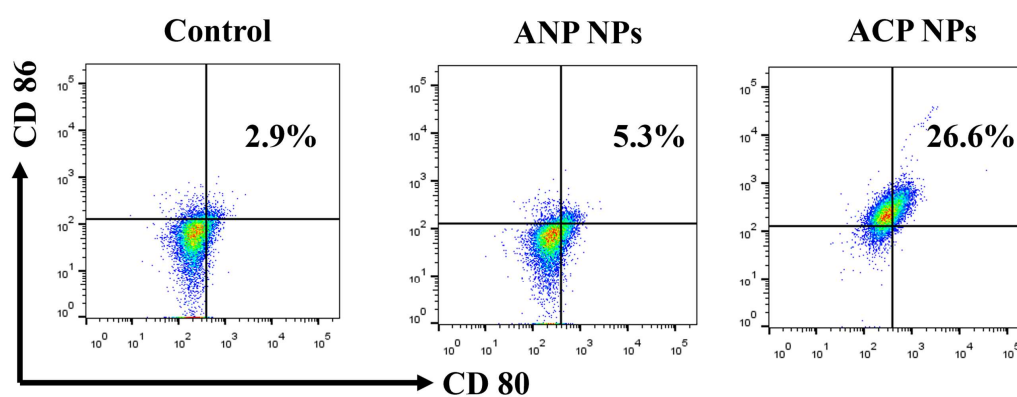
**Figure S3.** (A) Zeta potential of prepared nanoparticles. (B) UV-vis absorption spectra of Au@Non-CpG NPs and ANP NPs. (C) Hydraulic diameters of Au@Non-CpG NPs and ANP NPs.



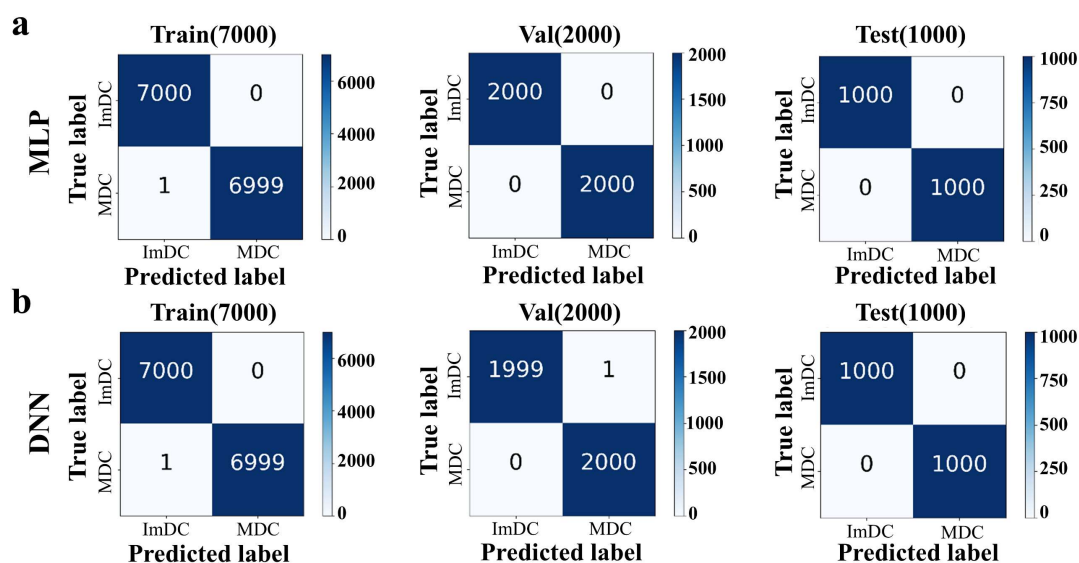
**Figure S4.** Cytotoxicity evaluation of the ACP NPs (A) and ANP NPs (B).



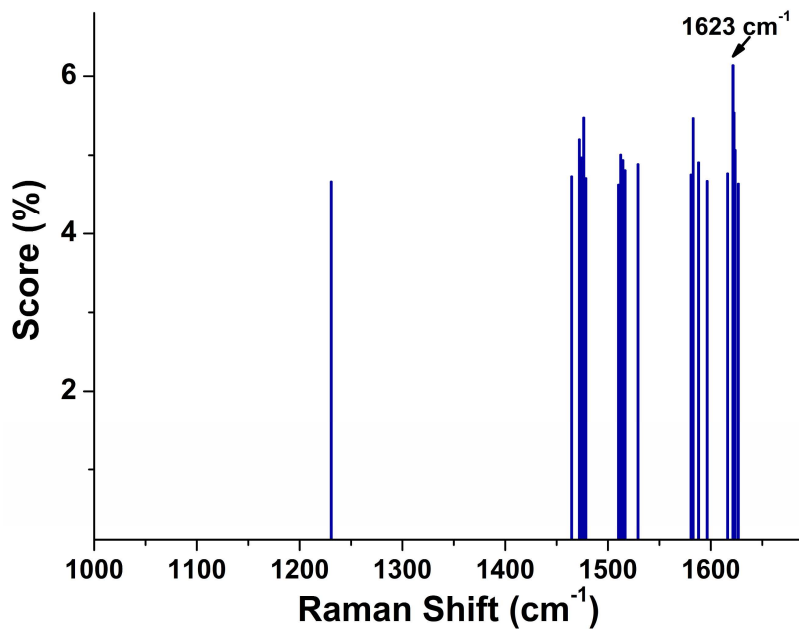
**Figure S5.** IL-6 (A) and TNF- $\alpha$  (B) detection of the DCs treated with Au NPs, ACP NPs or ANP NPs at different time points.



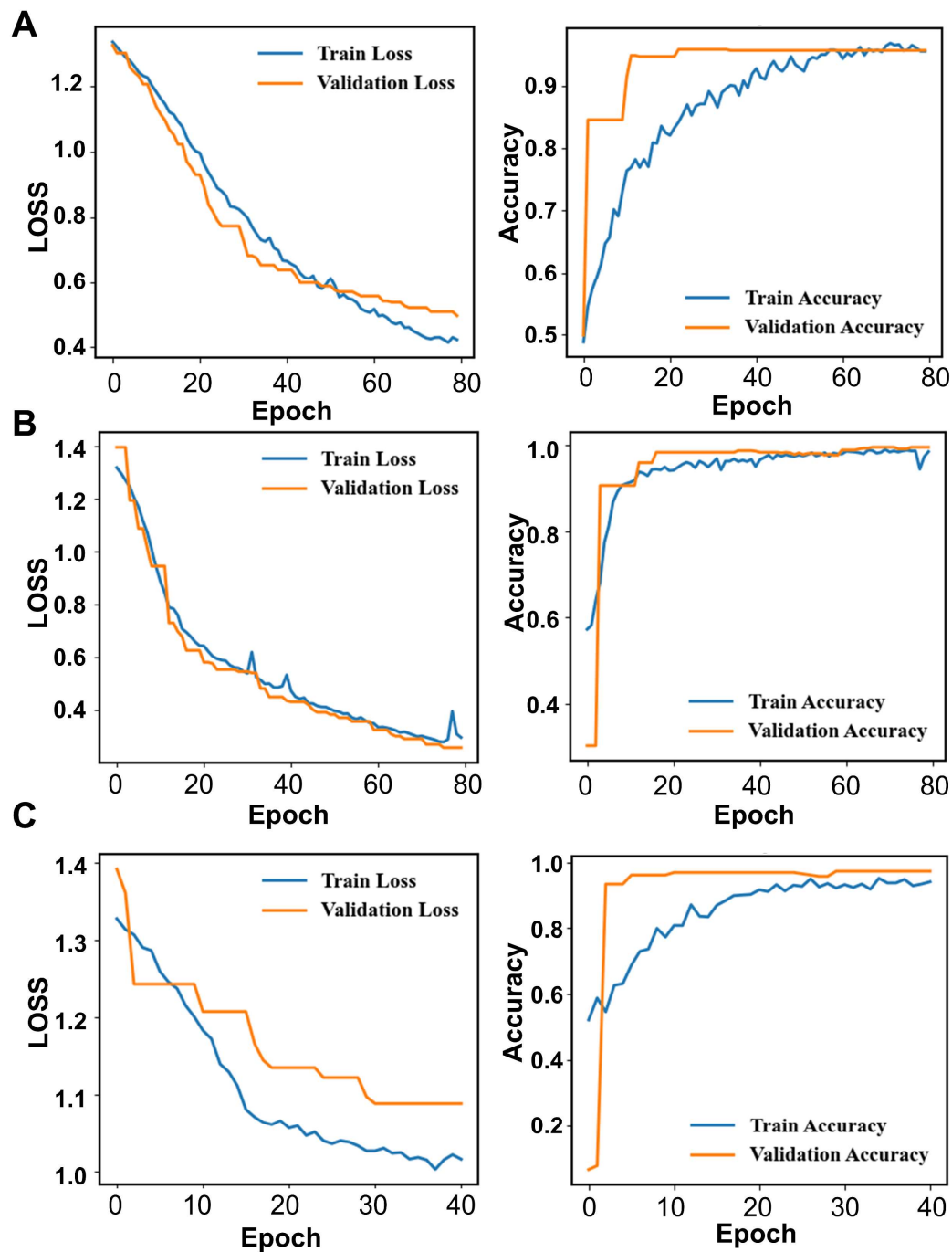
**Figure S6.** The expression levels of CD80 and CD86 markers in dendritic cells incubated with ANP or ACP nanoparticles, and the cell samples without any treatment were set as the control.



**Figure S7.** (A) Training, Validation and Test results from MLP algorithms. (B) Training, Validation and Test results from DNN algorithms.



**Figure S8.** The contribution of individual Raman spectral peaks to the CNN model's classification performance.



**Figure S9.** (A) LOSS and accuracy curves of the DCs status classification after incubation with nanoparticles for 2 h. (B) LOSS and accuracy curves of the DCs status classification after incubation with nanoparticles for 4 h. (C) LOSS and accuracy curves of the DCs status classification after incubation with nanoparticles for 6 h.