# Reshaping the oxidative stress microenvironment by Bionic chiral Cu-Phe (D/L) nanozymes for promoting osteoimmunomodulation and osteogenic differentiation

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## Supplementary results

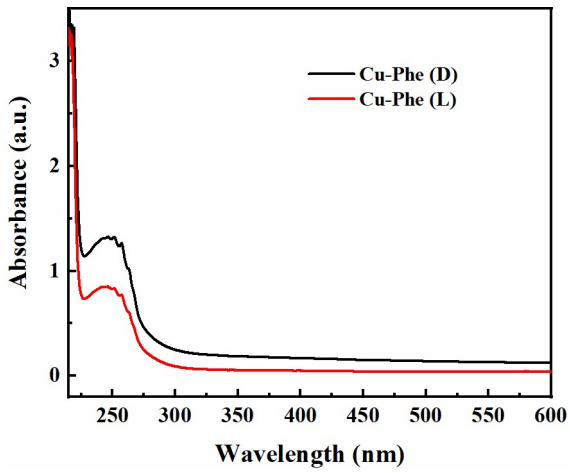



Figure S1. The UV /Vis analysis of Cu-Phe (D/L).

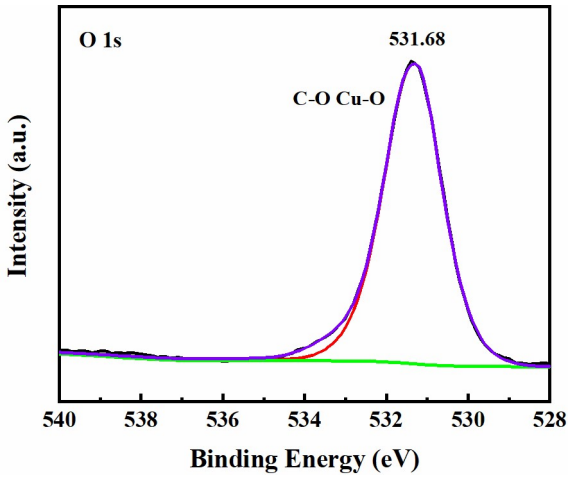



Figure S2. The O 1s spectra of Cu-Phe (D).

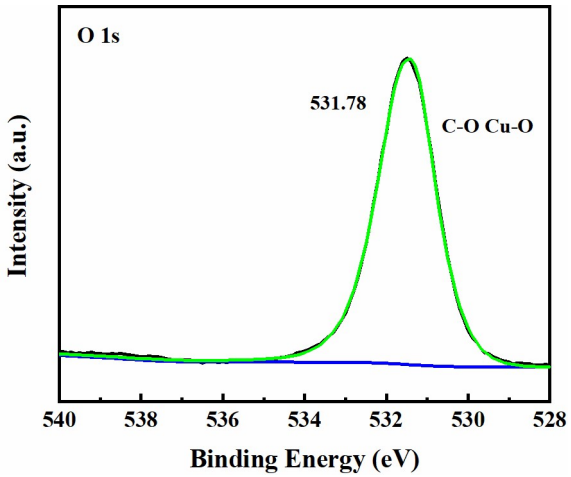



Figure S3. The O 1s spectra of Cu-Phe (L).

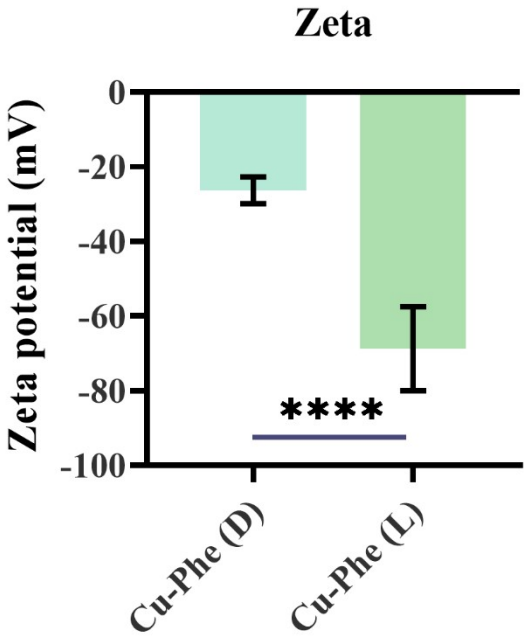



Figure S4. The zeta of Cu-Phe (D/L). Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

Table S1. The corresponding binding energies determined by XPS analysis for Cu-Phe (D/L).

| MOF | Binding energy O 1s/ eV | Binding energy Cu $2p_{3/2}$/eV | Difference in binding energies between the O 1s and Cu $2p_{3/2}$/ eV |
|---|---|---|---|
| **Cu-Phe (D)** | 531.68 | 934.13 | 402.45 |
| **Cu-Phe (L)** | 531.78 | 934.76 | 402.98 |

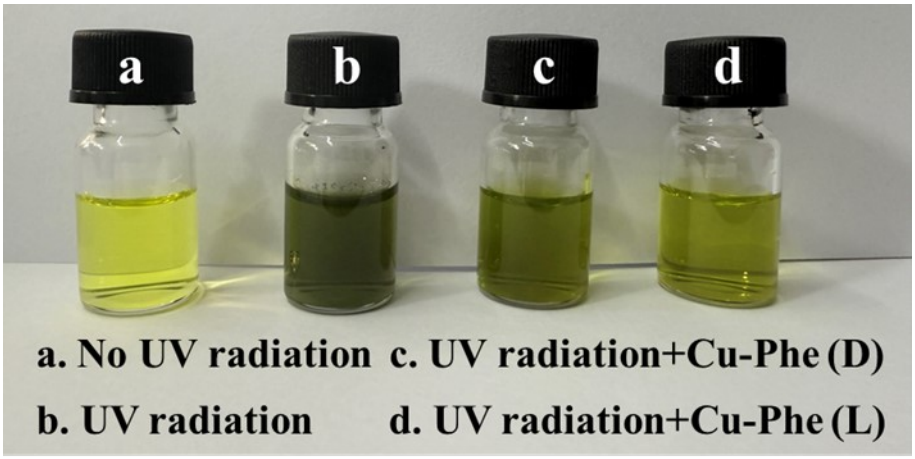



Figure S5. $\bullet O_2^-$ chromogenic image in the absence and presence of Cu-Phe (D/L).

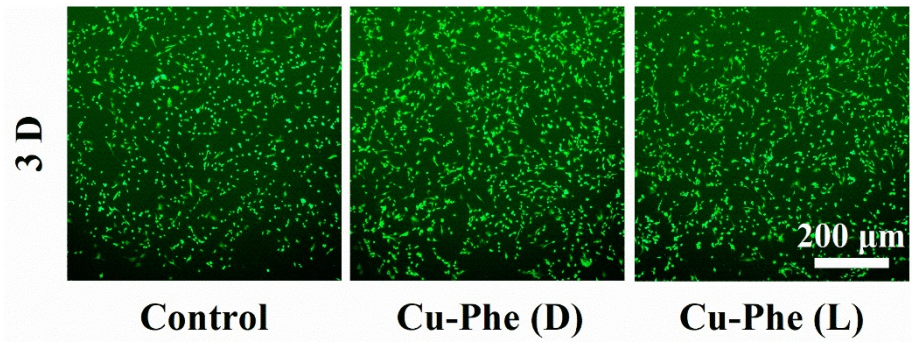



Figure S6. Live cell FDA staining result of BMSCs cells cultured with Cu-Phe (D/L).

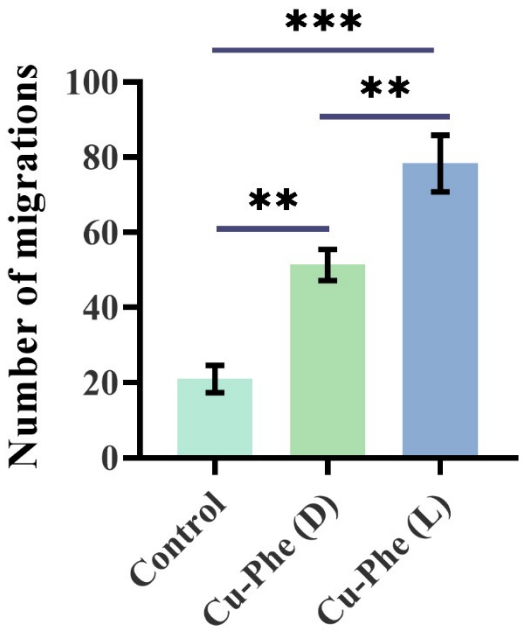



Figure S7. Tranwell quantitative analysis. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

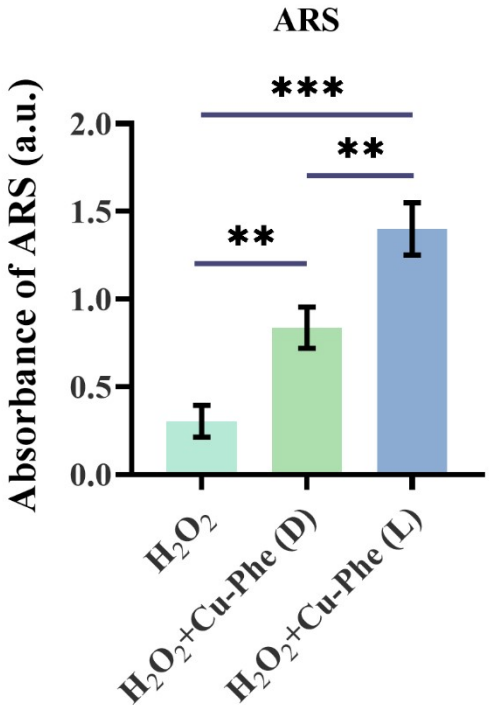



Figure S8. ARS quantitative analysis. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

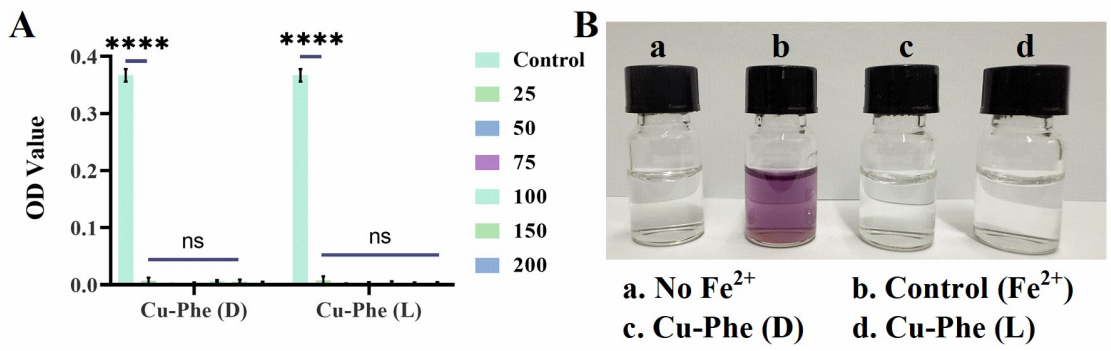



Figure S9. (A) Cu-Phe (D/L) potential Fenton reaction test; (B) 200 μg/mL Cu-Phe (D/L) Fenton reaction comparison chart. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

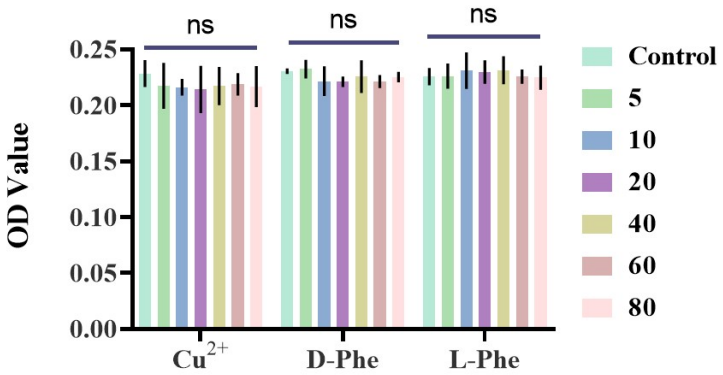



Figure S10. ▪$O_2^-$ scavenging capacity of $Cu^{2+}$, D-phenylalanine, and L-phenylalanine. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

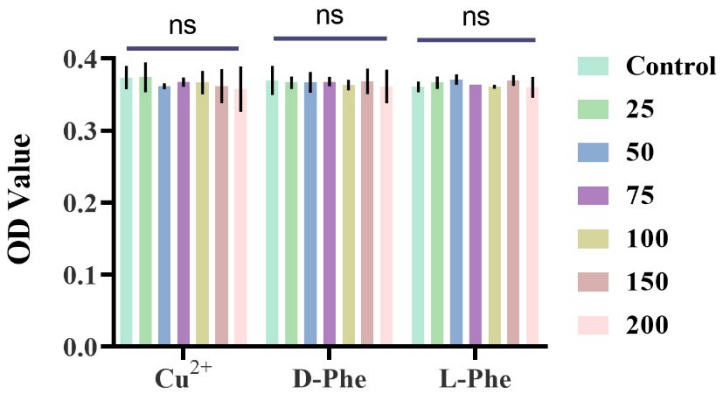



Figure S11. $H_2O_2$ scavenging capacity of $Cu^{2+}$, D-phenylalanine, and L-phenylalanine. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

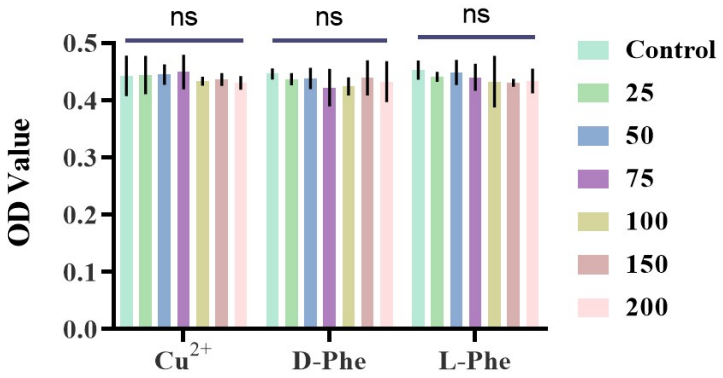
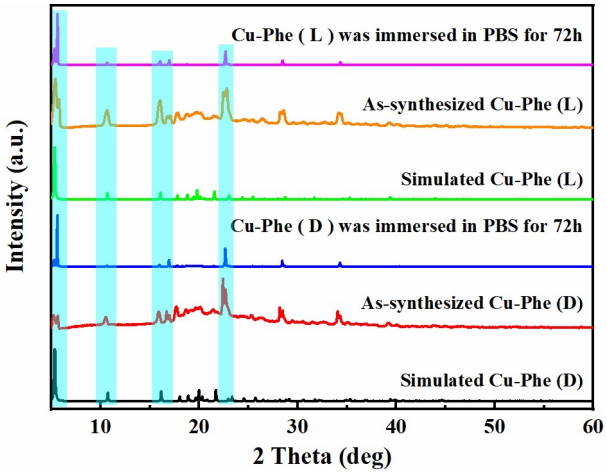



Figure S12. DPPH scavenging capacity of $Cu^{2+}$, D-phenylalanine, and L-phenylalanine. Data are mean values ± sd (n ≥ 3); *p < 0.05, **p < 0.01, ***p < 0.001, ****p < 0.0001.

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90 Figure S13. The nanozymes were immersed in PBS for 72 h to test XRD.

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