

## Supporting Information

# Thiol-Ene Click Chemistry-Mediated Space-Maintaining Janus Collagen Membrane for GBR with Antibacterial, Immunomodulatory, and Proangiogenic Functions

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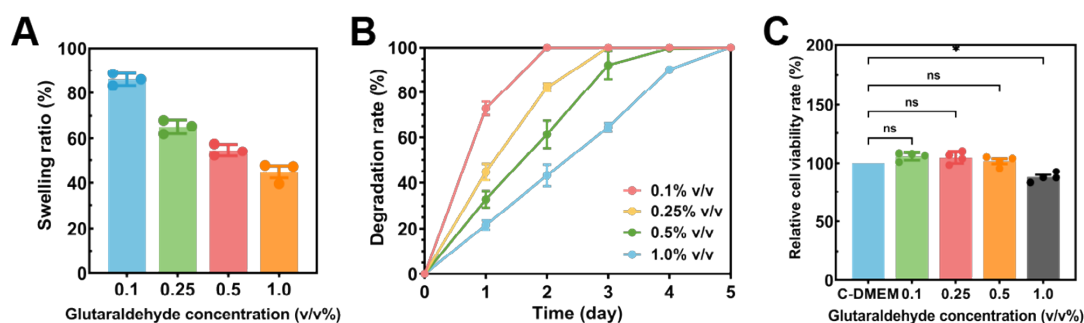
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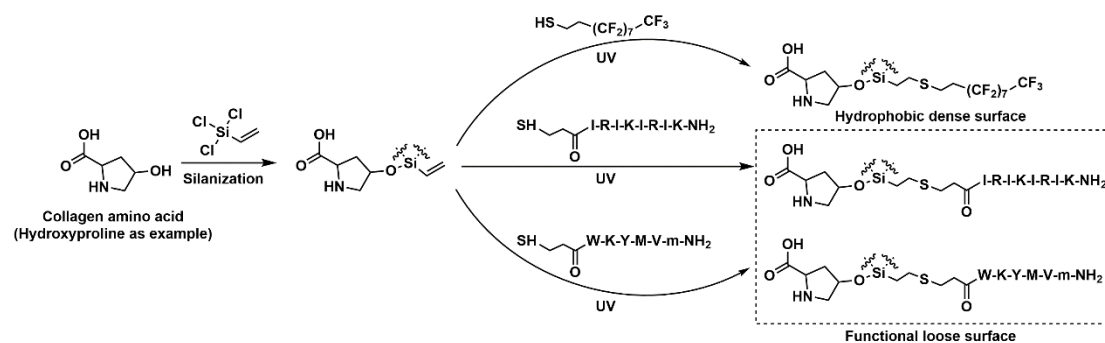
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## Supplementary Figures



**Fig. S1.** (A) Water swelling ratio of dried CM crosslinked with different glutaraldehyde concentrations after immersion in PBS for 24 h (n=3 per group). (B) Short-term degradation behavior of CM crosslinked with different glutaraldehyde concentrations in 10 U/mL type I collagenase solution (n=3 per group). (C) CCK-8 results for relative cytotoxicity of L929 cells exposed to 48 h extracts of CM (1.5 mg/mL) crosslinked with different glutaraldehyde concentrations. DMEM complete medium was set as the 100% control group (n=4 per group).



**Fig. S2.** The schematic diagrams of silanization and thiol-ene click reactions.

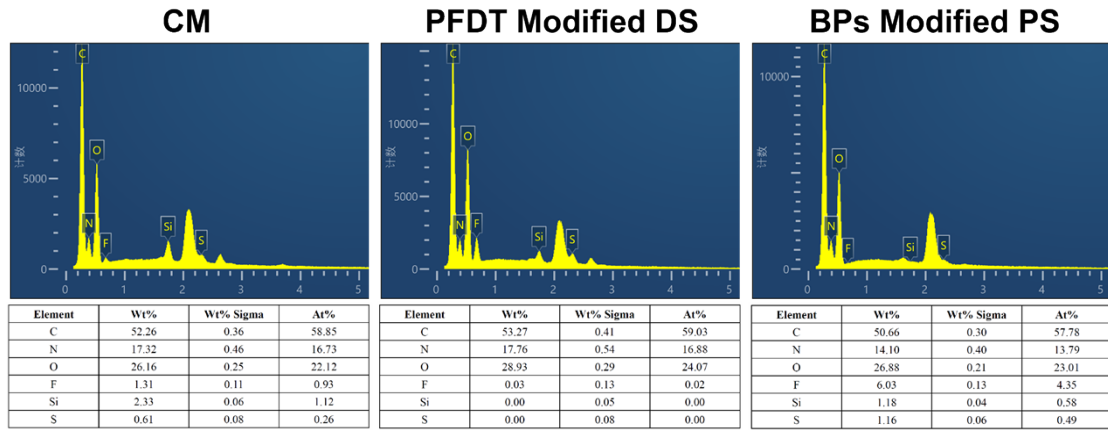


Fig. S3. EDS elemental composition, weight percentage (Wt%), and atomic percentage (At%) for both sides of CM and HAA-JM.

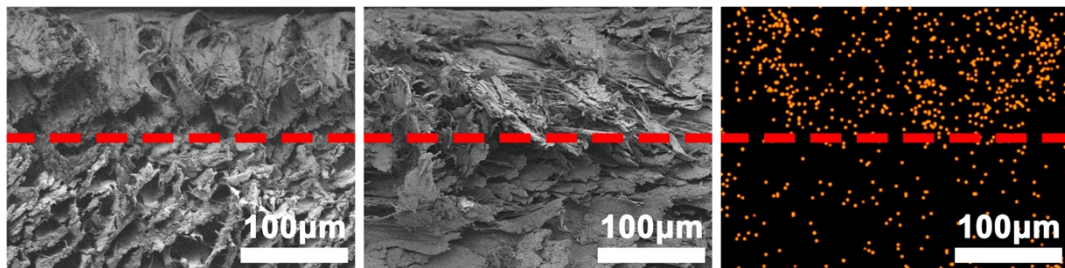


Fig. S4. Micrographs of the Janus boundary and spatial distribution of representative asymmetric elements (F as example) for CM and HAA-JM.

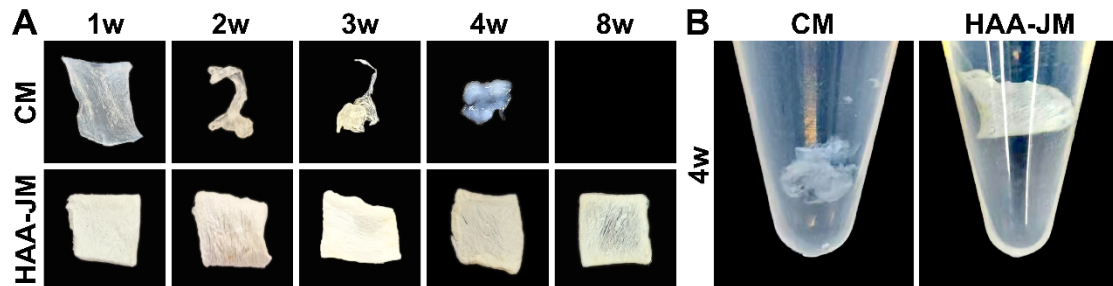
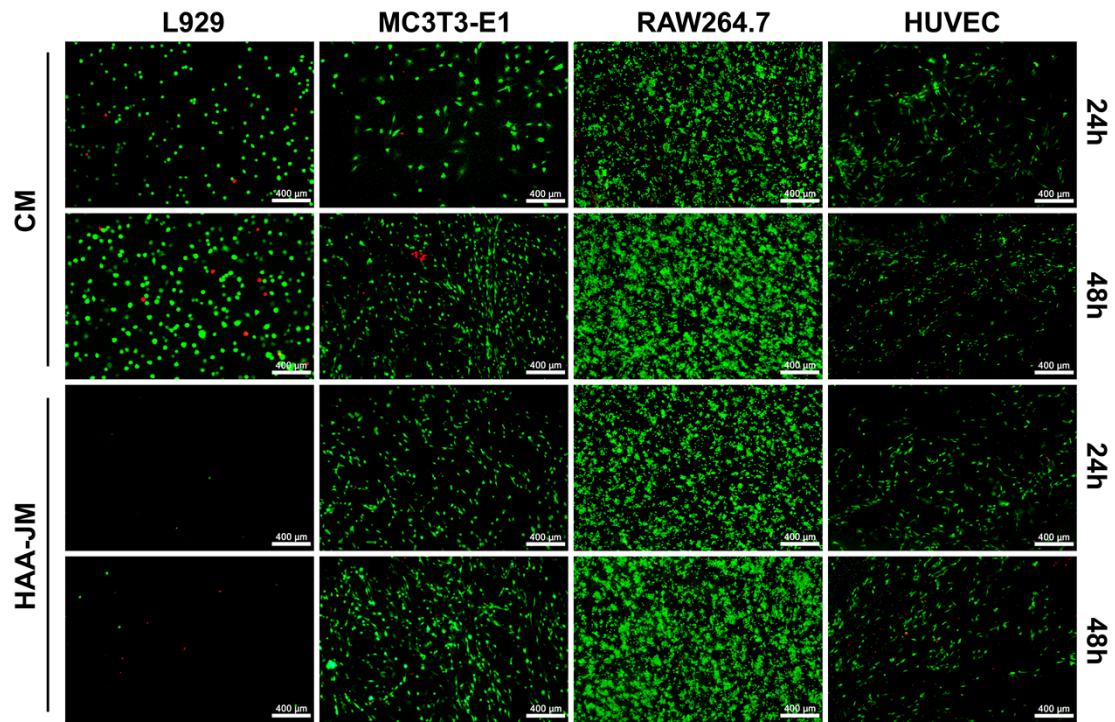
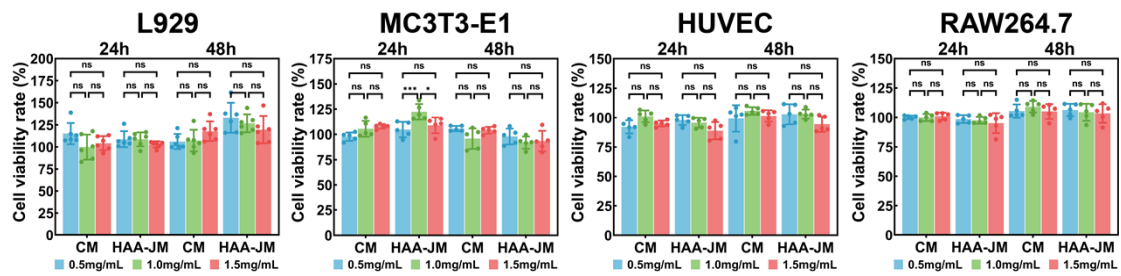


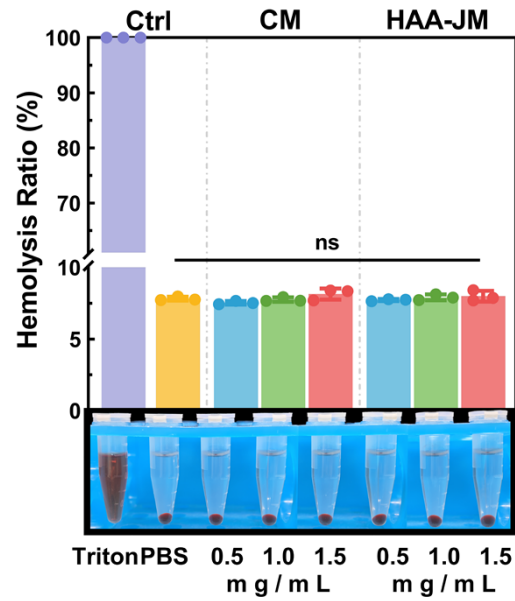
Fig. S5. (A) Comparison of macroscopic images of CM and HAA-JM in collagenase solution after drying (except CM in 4w) in the degradation experiment. (B) Physical states of CM and HAA-JM immersed in PBS at 4 weeks.



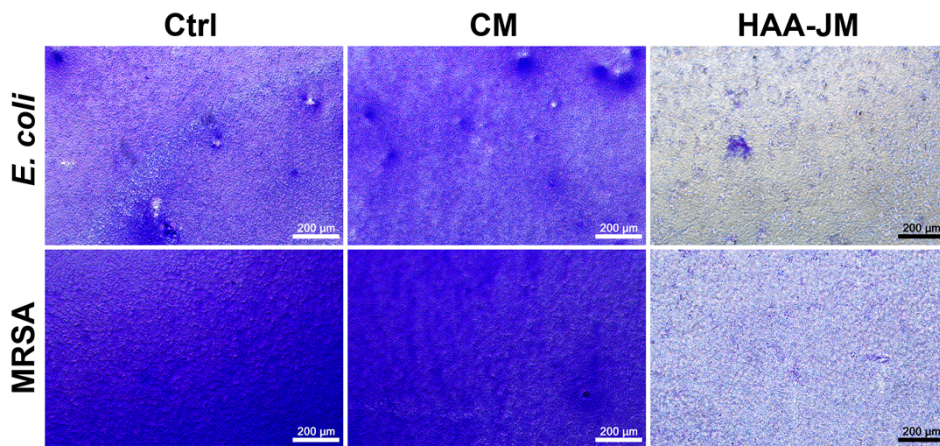
**Fig. S6.** Live/dead fluorescent images of L929, MC3T3-E1, RAW264.7 and HUVEC cells seeded on the surfaces of CM and HAA-JM membranes after 24h and 48h of culture. L929 cells were seeded on the dense side, while the other cell types were seeded on the porous side. Scale bar: 400 μm. n=3 per group at each time point.



**Fig. S7.** CCK-8 cell viability assay results of L929, MC3T3-E1, RAW264.7 and HUVEC cells cultured for 24h and 48h in the extraction media of CM and HAA-JM at different concentrations. Data are presented as the mean values (n=5 per group).



**Fig. S8.** Hemolysis rates of PBS extracts of CM and HAA-JM at different concentrations, and corresponding photographic images of each group in the hemolysis test. Data are presented as the mean values (n=3 per group, ns indicates no statistically significant difference).



**Fig. S9.** Microscopic images of *E. coli* and MRSA biofilms stained with crystal violet after co-culture with BHI broth extracts of different groups. Scale bar: 200  $\mu\text{m}$ .

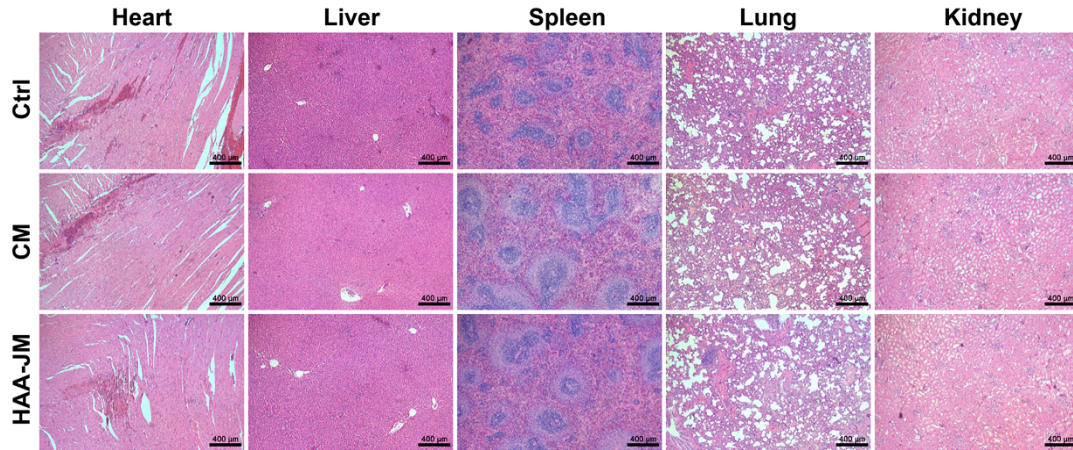


Fig. S10. HE staining images of major organs of rats in each group after the in vivo experiment. Scale bar: 400  $\mu\text{m}$ .

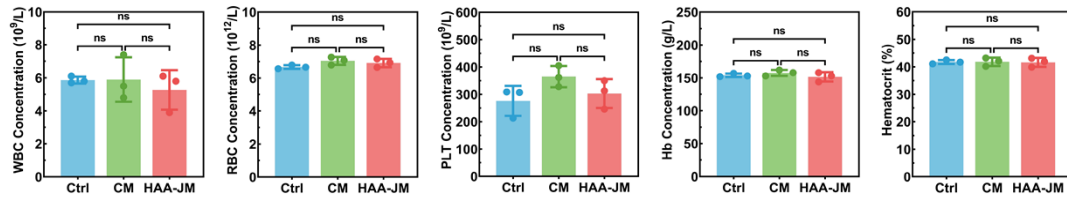


Fig. S11. Quantitative analyses of main hematological parameters (WBC, RBC, PLT, Hb and HCT) of rats. Data are presented as mean values ( $n=3$  per group, ns indicates no significant statistical difference).

### Supplementary Table

Parameters	Ctrl	CM	HAA-JM	References
White Blood Cells ( $10^9/\text{L}$ )	5.87	5.9	5.27	5~15
Red Blood Cells ( $10^{12}/\text{L}$ )	6.67	7.05	6.92	5~12
Platelets ( $10^9/\text{L}$ )	571	609	627	500~1200
Hemoglobin (g/L)	154	157.67	151.67	111~180
Hematocrit (%)	41.77	41.83	41.63	36~59

Table S1. Detection data of main indicators in rat routine blood tests (WBC, RBC, PLT, Hb, HCT). Data are presented as mean values ( $n=3$  per group).