Peptide Design Rules for Stem Cell Expansion on Alginate Hydrogels

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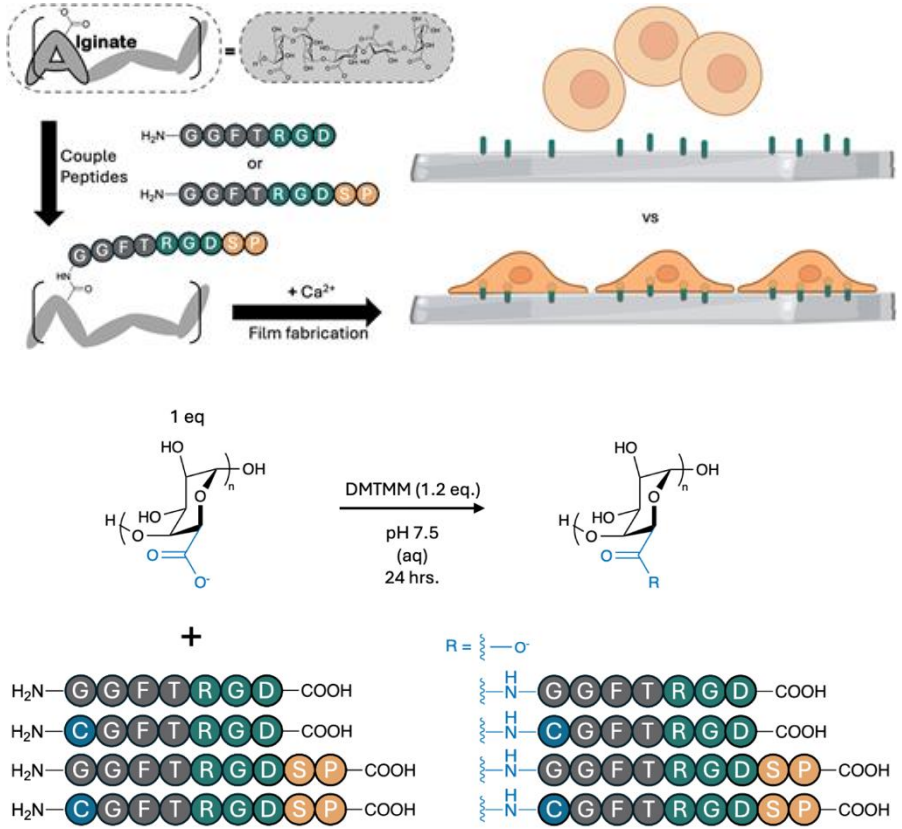
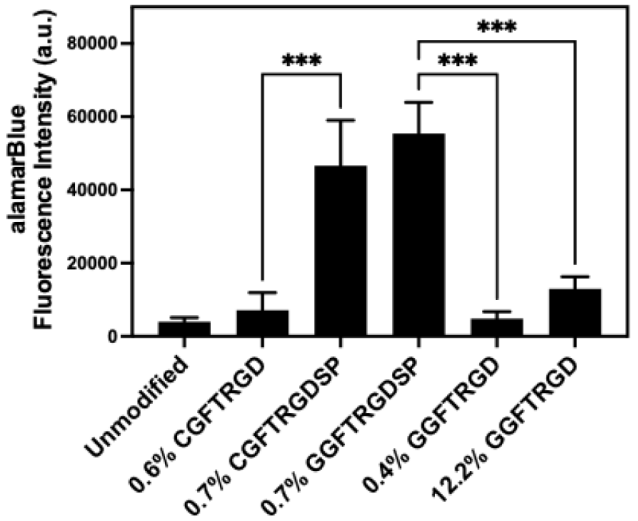
Alginate hydrogels are widely used biomaterials for cell culture and regenerative medicine, but successful expansion of adherent human mesenchymal stem cells (hMSCs) requires carefully engineered cell-adhesive cues. Researchers at the University of Minnesota and Roquette systematically investigated how peptide sequence and conjugation chemistry influence the bioactivity of RGD-functionalized alginate hydrogels. By designing and characterizing a series of peptide-alginate materials, they demonstrated that inclusion of a serine-proline (SP) sequence immediately following RGD dramatically improves hMSC attachment, spreading, and proliferation. The resulting peptide-functionalized hydrogels provide a foundation for scalable stem-cell expansion and therapeutic applications.

GlycoMIP supported molecular characterization of the alginate materials through its specialized polysaccharide characterization capabilities and expertise. Rigorous determination of alginate molecular properties was critical to establishing a well-defined hydrogel platform for investigating peptide-mediated stem-cell responses. This characterization helped ensure that differences in cell behavior could be attributed to peptide design rather than variations in the underlying alginate materials.





Figures. Top Left: Peptide-functionalized alginate hydrogels enable identification of peptide designs that promote human mesenchymal stem cell (hMSC) attachment, spreading, and proliferation. **Bottom Left:** DMTMM-mediated coupling of RGD-containing peptides to alginate. **Right:** Hydrogels functionalized with RGDSP-containing peptides supported more than a ten-fold increase in hMSC expansion relative to analogous hydrogels containing RGD alone.