Conformationally Constrained Functional Peptide Monolayers for the Controlled Display of Bioactive Carbohydrate Ligands

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Carbohydrate-mediated biomolecular interactions play a variety of roles in biological processes, including cell-cell signaling, host-pathogen interactions and tumor progression. The display of carbohydrate ligands on cell surfaces directly affects the binding strength and specificity of carbohydrates to other biomolecules. To interrogate these interactions, a biosensing platform with stable and tunable bioactivity is desired. Here we show that purposely-synthesized thiolated peptides, based on the highly conformationally constrained helicogenic α-aminoisobutyric acid (Aib) residue, form very strong and stable self-assembled monolayers on gold. Stability is realized by the formation of an extensive network of hydrogen bonds connecting neighboring peptides that retain their 3_{10}-helical structure. Based on these findings, we decorated the monolayer with increasingly larger amounts of a mannose-functionalized Aib-peptide, and surface-plasmon resonance revealed an outstanding performance of these mixed monolayers toward biorecognition of the lectin, concanavalin A.