Synopsis of Original Research Paper

Molecular design, synthesis and application of the peptides that specifically recognize collagen

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Many collagen-binding peptides have been reported to date. However, most of them seem to be below a practical level. Some do not possess enough affinity to detect collagen, and the others show little binding-specificity to collagen. We report here novel collagen-binding peptides that hybridize to denatured portions of collagen. They are parallel dimers of collagen-like peptides both ends of which are tethered by covalent linkages. The peptides, named cyclic collagen-mimetic peptides (cCMPs), showed approximately two orders of magnitude higher collagen-binding affinity than single-chain counterparts reported by Yu and co-workers. The collagen-detecting sensitivity of cCMPs was comparable to commercially available anti-collagen polyclonal antibodies in western blotting, and fluorescent staining of cultured cells. No collagen type selectivity was found, and the peptide recognized all types of collagen tested. In contrast, the peptides showed strong preference to denatured collagen. The results strongly support the common hybridizing mechanism targeting unfolding strands of collagen triple helix. Molecular dynamic simulations of the hybridized products suggested that the cCMP-collagen hybrid has higher stability than that of the corresponding hybrid with single-chain CMP. Some diseases such as osteoporosis and malignant cancer are suggested to be accompanied by collagen denaturation and/or degradation. It is also suggested that inflammation and mechanical stress also induce collagen denaturation. We expect practical applications of cCMPs to detecting conformational status of collagen *in vivo*.