Protein Engineered Biomaterials

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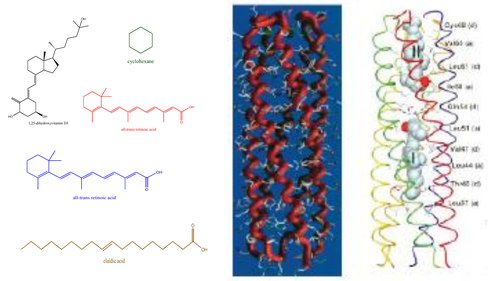
1 Abstract

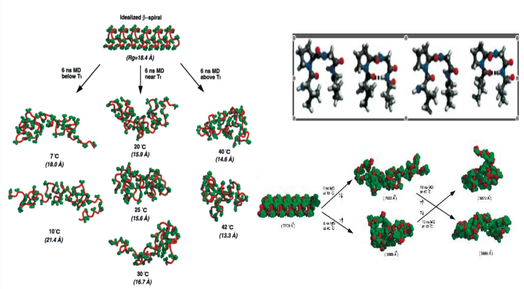
Advances in molecular biology techniques have been useful in engineering protein-based biomaterials. We aim to design novel synthetic biodegradable protein polymer constructs composed of unique block polymers via genetic engineering techniques. By combining cartilage oligomeric matrix protein coiled-coil (COMPcc) and elastin-like polypeptide (ELP), we can generate diblock and triblock copolymers. We have synthesized and purified the homopolymers COMPcc and ELP, along with the COMPcc-ELP and ELP-COMPcc diblock copolymers, as well as the triblock ELP-COMPcc-ELP. These polymers have been characterized via circular dichroism (CD), dynamic light scattering and fluorescence. In addition, we will use molecular biology techniques to generate block copolymers with smaller ELP sequences to understand the behavior of smaller ELPs.

2 COMPcc



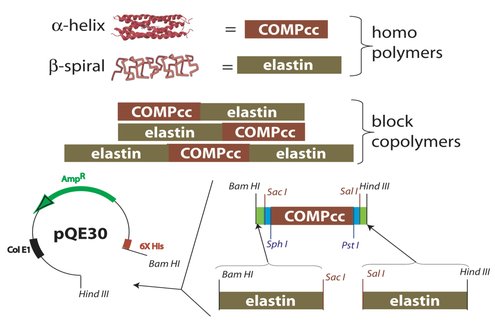
V. N. Malashkevich, R. A. Kammerer, V. P. Efimov, T. Schulthess, and J. Engel, *Science*, (**1996**) *274*, 761-765.

3 ELP

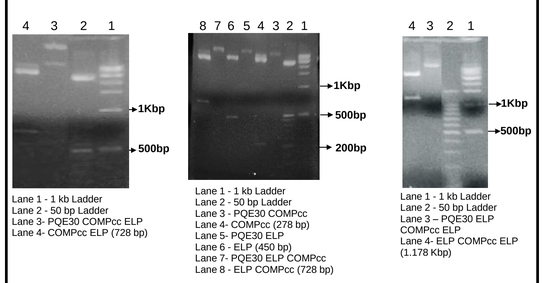


Li, B.; Alonso, D. O.; Daggett, V., The molecular basis for the inverse temperature transition of elastin. *J Mol Biol* **2001,** 305, (3), 581-92.

4 Biosynthesis of Block Co-Polymers



5 COMPcc & ELP Clones

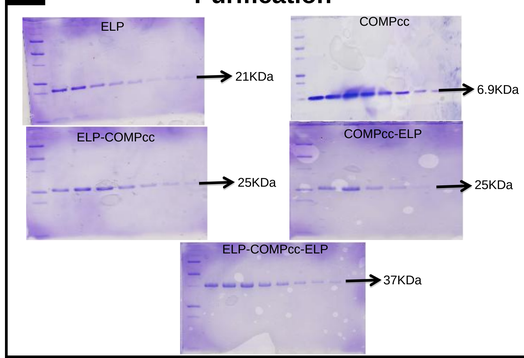


Lane 1 - 1 kb Ladder
Lane 2 - 50 bp Ladder
Lane 3- PQE30 COMPcc ELP
Lane 4- COMPcc ELP (728 bp)

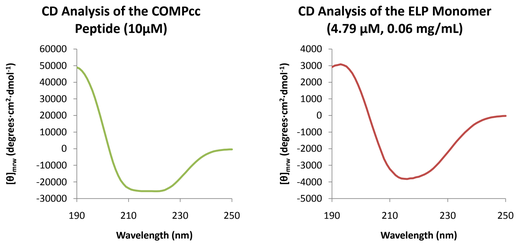
Lane 1 - 1 kb Ladder
Lane 2 - 50 bp Ladder
Lane 3 - PQE30 COMPcc
Lane 4- COMPcc (278 bp)
Lane 5- PQE30 ELP
Lane 6 - ELP (450 bp)
Lane 7- PQE30 ELP COMPcc
Lane 8 - ELP COMPcc (728 bp)

Lane 1 - 1 kb Ladder
Lane 2 - 50 bp Ladder
Lane 3 – PQE30 ELP COMPcc ELP
Lane 4- ELP COMPcc ELP (1.178 Kbp)

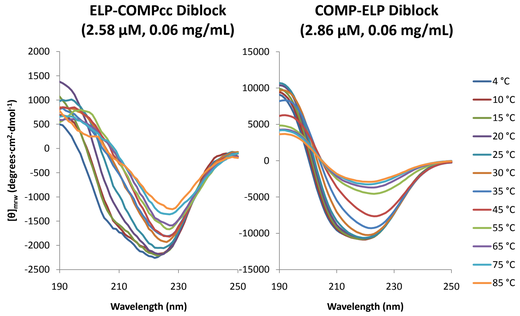
7 Purification



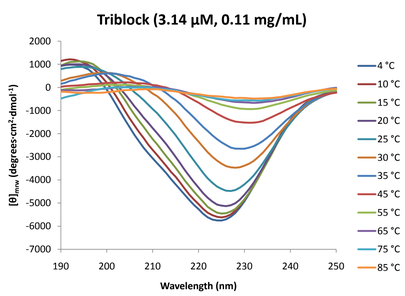
7 Homopolymer CD



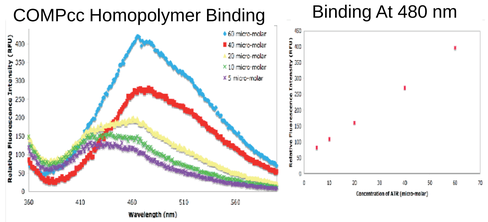
8 Di-Block Polymer CD

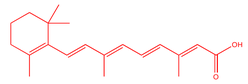


9 Tri-Block Polymer CD



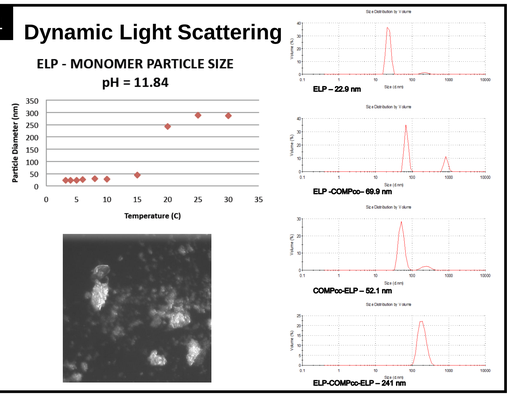
10 Fluorescence





all-trans retinoic acid

11 Dynamic Light Scattering



12 Conclusions & Future Work

-We have successfully generated and purified all constructs including the homopolymer, di-block co-polymers, and tri-block co-polymer.

-We have preliminary results for characterization of the constructs via CD, Fluorescence, and AFM. We will continue to characterize constructs via fluorescence, dynamic light scattering, and MALDI in the future.

-We hope these block co-polymers will provide protein engineers with an extra level of control for drug delivery. These will also serve as novel scaffolds for tissue engineers.

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