Novel Fusion Protein Approach to Cardiovascular Disease With Computational Modelling

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Cardiovascular disease (CVD) causes 20.5 million deaths annually and imposes significant economic burdens due to rising healthcare costs. While pharmacological treatments and surgeries are the current primary interventions, high costs and side effects limit access and worsen health disparities, impacting patients' quality of life. Our project aims to produce a fusion protein using synthetic biology, TP1P5, to provide a more affordable, effective and comprehensive supplement to prevent the occurrence of CVDs. TP1P5 is created by fusing ginsentide TP1 and lupin peptide P5.The protein has vasodilating, prothrombotic properties, and it can lower the plasma cholesterol in the human body. The structure of TP1P5 was successfully predicted, along with models for TP1, P5, P2Y12r, and PCSK9, as TP1P5 structures were unavailable online. The structure was visualized using PyMOL, and reliable synthesis was indicated by AlphaFold. The viability of TP1P5 in the human body was confirmed through stability tests, with four disulfide bonds enhancing its stability. It was shown through solubility tests that TP1P5 is insoluble across various pH levels, and thermostability assessments confirmed its stability at body temperature. Binding with P2Y12r and PCSK9 was verified through docking studies. Recombinant plasmids are designed for culturing inside E.coli, and then the cells are lysed and purified for SDS page to prove the size of the protein is the same as the hypothesized size. ELISA kits are then conducted, to test if our proteins could bind with the proteins they target. A color change was observed and this demonstrated the binding success of our protein. We also got the ideal concentration of our proteins from the data of the ELISA kits and cell lines.

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