Laboratory for Protein Design

Institute for Protein Research

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Proteins fold into unique three-dimensional structures from random coils to perform their functions. The current observed shapes of naturally occurring proteins are the result of billions of years of evolution, and analyzing them alone presents challenges in fully understanding the mechanisms of protein folding and function. Our research aims to elucidate the principles of protein folding and function through the computational design of novel proteins, followed by biochemical assays to examine the behavior of the designed proteins. Moreover, we strive to develop de novo design methods for proteins with applications in industries and therapeutics.

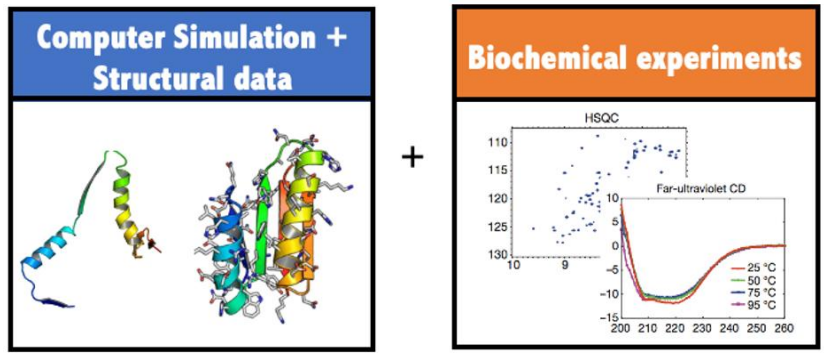

Fig.1 De novo design of proteins by using computer simulations and biochemical experiments

Design of proteins completely from scratch

We have discovered rules for designing proteins of various shapes by focusing on the backbone structures, such as secondary structure and loop lengths, rather than on the details of the amino acid sequences. Using these rules, we have successfully designed protein structures of various shapes with atomic-level precision. Currently, we are working to create functional proteins using the designed proteins as building blocks.

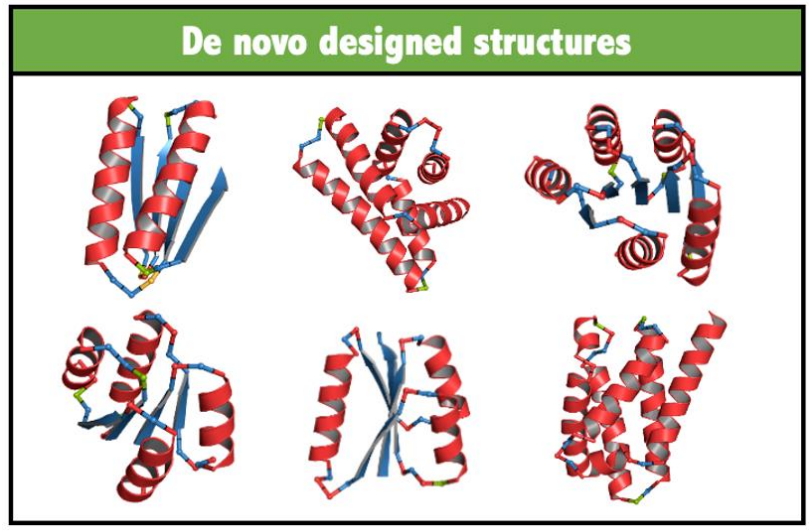

Fig.2 Designed proteins from scratch

Redesign of naturally occurring proteins to improve functionality and stability

By using protein design methods developed in the process of designing novel proteins from scratch, we aim to redesign naturally occurring proteins to improve their stability and to endow them with new functions.

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