

## Protein Tools for Turning on/off Genes in Synthetic Biology Systems

Over the past decade, the growing field of synthetic biology has allowed the manipulation of an organism's biological system for a specific purpose. To avoid unwanted interactions, non-host molecular components can be used to create orthogonal proteins. We developed a DNA-binding protein that is orthogonal to any host system by combining bacterial and mammalian transcription factor elements. Our protein HinZip recognizes and strongly binds a large DNA site of at least 24 base pairs with high specificity and selectivity. This results in selective regulation of gene circuits by recognition of a large, unique DNA sequence inserted in the host's genome. HinZip is easily expressed in bacterial systems, for which fewer synthetic biology tools exist. We tested HinZip in a bacterial-one-hybrid system that ties the survival of *E. coli* cells with HinZip binding to a target site, showcasing HinZip's ability to function in bacterial synthetic circuits. This can be generalized to any synthetic biological system making it a versatile synthetic biology modulator.