

## Supporting Information:

### Complete Refs.

[23] Berman, H. M.; Battistuz, T.; Bhat, T. N.; Bluhm, W. F.; Bourne, P. E.; Burkhardt, K.; Feng, Z.; Gilliland, G. L.; Iype, L.; Jain, S.; Fagan, P.; Marvin, J.; Padilla, D.; Ravichandran, V.; Schneider, B.; Thanki, N.; Weissig, H.; Westbrook, J. D. Zardecki, C. 2002, Acta Crystallogr D Biol Crystallogr., 58, 899-907.

[90] MacKerell, A. D., Bashford D.; Bellott, M.; Dunbrack, R. L.; Evanseck, J. D.; Field, M. J.; Fischer, S.; Gao, J.; Guo, H.; Ha, S.; Joseph-McCarthy, D.; Kucnhir, L.; Kuczera, K.; Lau, F. T. K.; Mattos, C.; Michnick, S.; Ngo, T.; Nguyen, D. T.; Prodhom, B.; Reiher, W. E.; Roux, B.; Schlenkrick, M.; Smith, J. C.; Stote, R.; Straub, J.; Watanabe, M.; Wiorkiewicz-Kuczera, J.; Yin, D.; Karplus, M. (1998) J. Phys. Chem. B, 102, 3586-3616

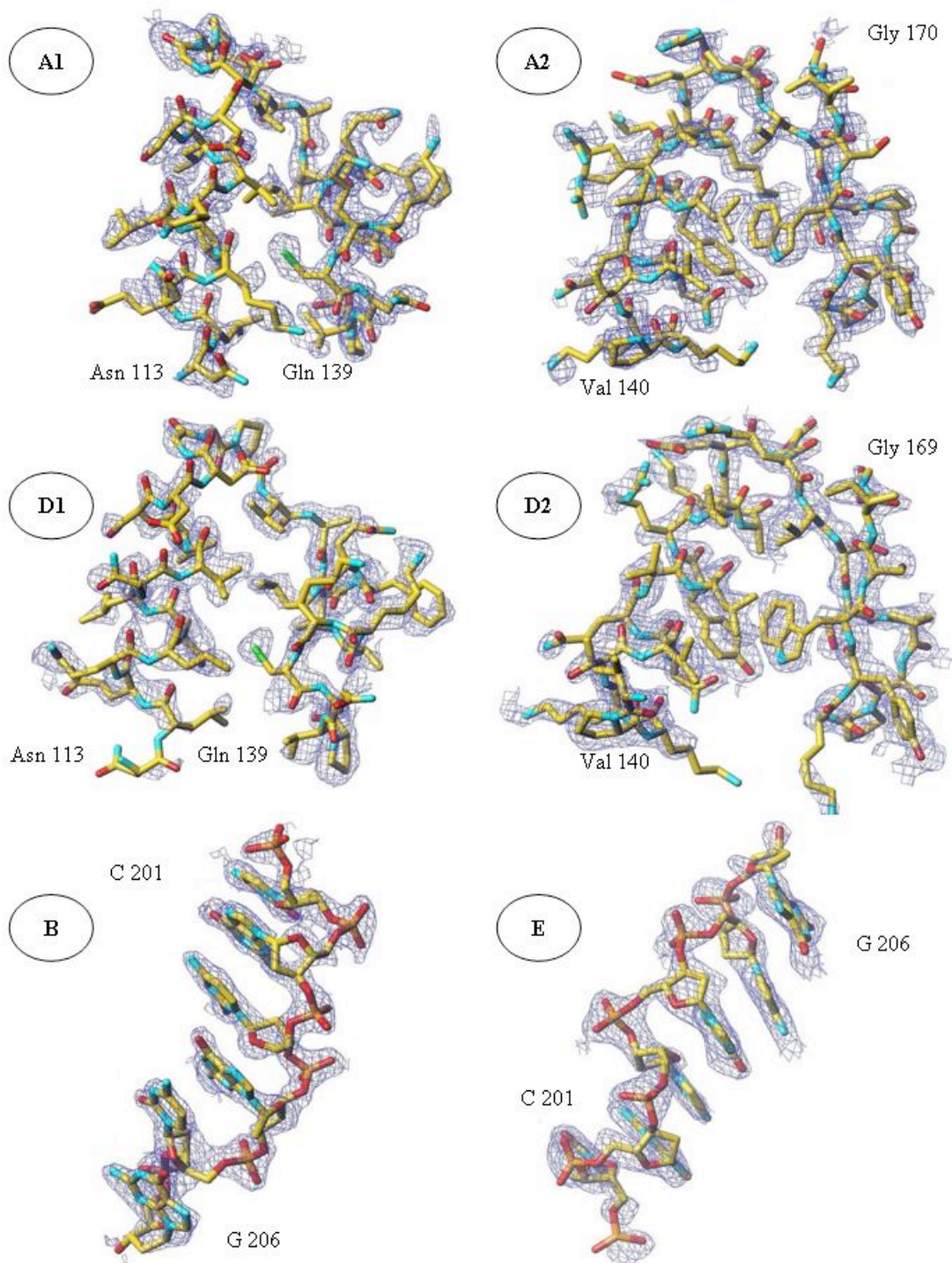
### Chemical synthesis

Mini-Proteins	Resin	Loading (mmol)
1H5O	Fmoc-gly-Wang	0.610
1H5O mutants	Fmoc-gly-PAL-PEG-PS	0.250
1HZ6, 1HZ6 mutants	Fmoc-gly-Wang	0.610
1CKK, 1CKK mutants	Fmoc-phe-Wang	0.640

### Purification / characterization of mini-proteins

Mini-proteins	Purification gradient	$T_{elut.}$	$M_{exp}$	$M_{theo}$	$e_{(280)theo}$	$e_{(280)exp}$
1J75wt	0-92' 20-100%	27'	7317.1	7317.4	6990	6670
1J75mt	0-92' 20-100%	30'	7484.5	7484.7	8480	7320
1J75mtK130A	0-92' 20-100%	32'	7427.6	7427.6	8480	7020
1J75mtK117A	0-92' 20-100%	31'	7427.4	7427.6	8480	7670
1J75mtK164A	0-92' 20-100%	31'	7427.2	7427.6	8480	7720
1J75mtF132A	0-92' 20-100%	29'	7408.4	7408.6	8480	7890
1J75mtC138V	0-92' 20-100%	29'	7480.7	7480.7	8480	11260
1J75mtFSKY/A	0-92' 20-100%	30'	7242.8	7243.7	6990	6450
1H5Owt (red)	0-4' 5-15%/4-34' 15-25%	24'	4889.8	4889.8	12865	n.d.
1H5Owt(ox)	0-4' 5-15%/4-34' 15-25%	16'	4883.0	4883.8	13020	12490
1H5Omt1(re)	0-4' 5-15%/4-34' 15-25%	23'	4787.8	4787.7	8855	n.d.
1H5Omt1(ox)	0-4' 5-15%/4-34' 15-25%	17'	4781.0	4781.7	9055	8480
1H5Omt3(re)	0-10' 5%/10-14' 5-15%/14-40' 15-30%	28'	4638.6	4638.5	7365	n.d.
1H5Omt3(ox)	0-10' 5%/10-14' 5-15%/14-40' 15-30%	26'	4632.4	4632.5	7940	6990
1H5Omt4(re)	0-10' 5%/10-14' 5-15%/14-40' 15-30%	27'	4787.3	4788.6	8855	n.d.
1H5Omt4(ox)	0-10' 5%/10-14' 5-15%/14-40' 15-30%	26'	4782.4	4782.6	9100	8480
1CKK wt	0-5' 0-30%/5-25' 30-50%	16'	3018.5	3018.7	7800	5500
1CKK mt	0-5' 0-30%/5-25' 30-50%	14'	3107.6	3017.8	6480	6990
1HZ6 wt	0-10' 5%/10-14' 5-25%/14-42' 25-35%	42'	6882.8	6883.5	11960	9970
1HZ6 mt	0-10' 5%/10-14' 5-25%/14-42' 25-35%	39'	6925.6	6926.7	12730	9970

Weighted 2Fo-Fc omit maps calculated for 1J75\_m\_K130A contoured at 1  $\sigma$ : A1-D1: Residues From N113 to Q139 were omitted in the model; ; A2: Residues From V140 to G170 were omitted in the model; D2 : Residues From V140 to G169 were omitted in the model. B-E : DNA was omitted in the model.



Superimposition of the dichroic spectra of the designed proteins and their corresponding native scaffolds.

