Supplementary material

Supplementary Table 1. Amino acid descriptors

List of descriptors and their abbreviations used for correlation analysis.

Descriptors	**Abbreviation**
Number of atoms (including implicit hydrogens).	a_count
Number of heavy atoms	a_heavy
Number of hydrophobic atoms	a_hyd
Water accessible surface area calculated using a radius of 1.4 A for the water molecule	ASA
Water accessible surface area of all polar atoms. Accessible surface area refers to the water accessible surface area using a probe radius of 1.4 Angstroms	ASA_P
Number of bonds (including implicit hydrogens).	b_count
Number of rotatable bonds. Topological parameter is a measure of molecular flexibility. A bond is rotatable if it has order 1, is not in a ring, and has at least two heavy neighbors	b_rotN
Hydropathy index of an amino acid (number representing the hydrophobic or hydrophilic properties of its side-chain)	**Hydrophobicity**[a]
Turn propensity scale for transmembrane helices	Helix turn propensity[b]
The number of O and N atoms	lip_acc
The number of OH and NH atoms	lip_don
Log of the octanol/water partition coefficient	logP(o/w)
Amino acid side chain flexibility	t-Flx[c]
Amino acid side chain rigidity	t-Rig[c]
Area of van der Waals surface	vdw_area
van der Waals volume	vdw_vol
Molecular weight.	weight

[a] Kyte and Doolittle (1982)

[b] Monne et al. (1999)

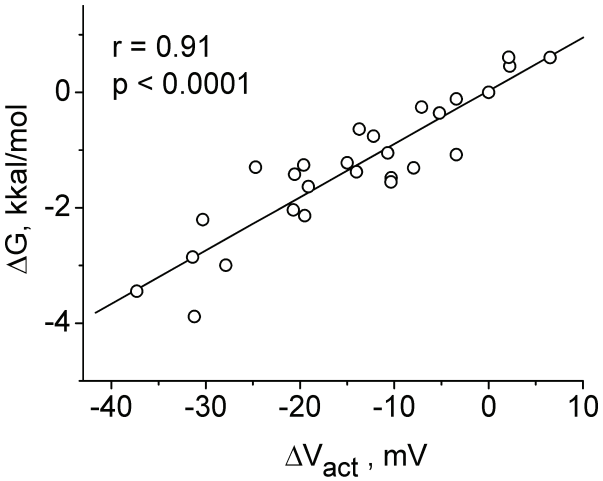
[c] Gottfries and Eriksson (2009)

Supplementary Table 2. Calculated amino acid descriptors

Calculated values of descriptors for each amino acid

Amino acid	a_count	a_heavy	a_hyd	ASA, Å^2	ASA_P, Å^2	b_count
A	13	6	2	242.74324	0	12
C	14	7	2	273.85648	224.60548	13
D	15	9	2	278.12979	225.49535	14
E	18	10	3	313.17535	235.8358	17
F	23	12	8	360.759	135.49438	23
G	10	5	1	217.82974	0	9
H	20	11	4	332.29614	208.60524	20
I	22	9	5	310.68332	143.2991	21
K	25	10	5	361.34518	217.77553	24
L	22	9	5	322.46146	181.95142	21
M	20	9	5	337.17654	184.87408	19
N	17	9	2	291.38504	247.48032	16
P	17	8	4	279.61813	86.08024	17
Q	20	10	3	323.83051	249.88791	19
R	27	12	4	389.96347	291.78641	26
S	14	7	2	259.00809	200.8197	13
T	17	8	3	280.57605	180.75769	16
V	19	8	4	289.1181	170.4135	18
W	27	15	10	393.14545	202.4926	28
Y	24	13	8	372.37411	232.85223	24

Amino acid	b_rotN	lip_acc	lip_don	logP(o/w)	vdw_area, Å^2	vdw_vol, Å^3
A	1	3	1	-0.538	107.75999	111.04782
C	2	3	1	-0.428	129.56839	132.36894
D	3	5	1	-1.165	135.29059	140.78549
E	4	5	1	-0.723	152.52267	165.21468
F	3	3	1	0.997	178.25824	226.02168
G	1	3	1	-1	90.52791	86.61864
H	3	5	2	-1.307	161.0999	190.2766
I	3	3	1	0.876	160.8013	184.33536
K	5	4	2	-0.469	176.59799	202.89105
L	3	3	1	0.876	160.8013	184.33536
M	4	3	1	0.117	165.9369	182.28906
N	3	5	2	-2.02	143.85384	151.32716
P	1	3	1	0.178	122.67898	147.62587
Q	4	5	2	-1.578	161.08592	175.75635
R	5	6	4	-0.542	204.6192	227.01431
S	2	4	2	-1.573	117.78994	119.57003
T	2	4	2	-1.111	135.02202	143.99921
V	2	3	1	0.434	143.56921	159.90617
W	3	4	2	1.363	200.41324	271.36938
Y	3	4	2	0.689	188.28818	234.5439



Supplementary Fig. 1 Correlation between ΔV_{act} and changes in free energy (ΔG)

Each point represents the mean value of ΔV_{act} and ΔG ($n \geq 5$) of all studied mutants.