

SUPPORTING INFORMATION FOR

Saturation mutagenesis of the transmembrane region of HokC in *Escherichia coli* reveals its high tolerance to mutations

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I. Supplemental Tables

Table S1. Colonies counted under different IPTG concentrations.

IPTG (mM)	Exp 1	Control	Exp 2	Control	Exp 3	Control
0.01	86	237	105	105	107	162
0.05	---	253	---	241	---	151
0.1	---	124	---	230	---	334
0.2	---	192	---	120	---	268
0.4	---	213	---	211	---	218
0.6	---	227	---	245	---	231
0.8	---	263	---	210	---	202

Exp: Experiment; cells were grown in the presence of Kan 10 microg/mL and the indicated concentration of IPTG. Control: cells were grown in the absence of IPTG, only in the presence of Kan 10 microg/mL.

Table S2. Observed phenotypes per mutated region of HokC.

Region	Total isolated colonies	Wild-type phenotype	Mutant phenotype
I (2-6)	960	531	429
II (7-9)	1015	807	208
III (10-12)	931	346	585
IV (13-15)	914	320	594
V* (16-18)	945	246	699
VI (19-21)	877	657	220
VII (22-24)	777	299	478

The mutated regions (I to VII; in parenthesis the positions included in each region is reported), with their corresponding number of isolated colonies identified with

mutant or wild-type phenotype are presented. Region V was reported previously by our group and is presented here for comparison.

Table S3. Single-residue mutations found in every mutant of HokC with wild-type (A) and mutant (B) phenotypes.

A)

Mutation	Occurrences
V9*	302
K2T	11672
Y47X	15
K2S	10488
K2R	40027
K2Q	2167
Y47T	6732
K2P	826
Y47S	102
K2N	8232
Y47R	5184
K2M	965
K2L	111
Y47N	37
K2I	121
K2H	395
K2G	327
K2F	46
K2E	3448
K2D	688
Y47H	59
K2C	118
Y47F	65
K2A	2241
Y47E	1

Y47D	32
Y47C	146
K2*	843
Y47*	58
V20Y	1
V20X	3871
V20W	9452
V20T	12239
V20S	114
V20R	508
V20Q	546
V20P	5867
V20N	251
V20M	2389
V20L	3140
V20K	277
V20I	287
V20H	15
V20G	14772
V20F	291
V20E	1713
V20D	1290
V20C	11
V20A	9061
V19Y	3132
V19X	3891
V19W	15
V19T	2374
V19S	6610

V19R	1896
V19Q	9543
V19P	5428
V19N	2653
V19M	929
V19L	11277
V19K	10
V19I	456
V20*	18
V19H	1205
V19G	7525
V19F	2628
V19E	1089
V19D	420
V19C	326
V19A	297
T45X	1
T45V	1
T45S	136
T45R	6750
T45Q	2
T45P	330
T45M	665
T45L	1
T45K	70
T45I	1
T45G	5177
V19*	6827
T45E	1

T45D	2
T45A	529
E50Y	1
A10Y	1599
E50X	1
A10X	206
E50W	1
E50V	5220
A10W	958
A10V	5845
A10T	4005
E50S	6729
A10S	5778
A10R	2876
E50Q	8
A10Q	18
A10P	53509
A10N	623
A10M	36
A10L	1722
E50K	132
A10K	1255
A10I	1039
E50H	1
A10H	621
E50G	74
A10G	23322
A10F	771
A10E	275

E50D	30
A10D	1705
T45*	2
A10C	1697
E50A	20
E50*	39
A10*	49
R26X	2
I8Y	105
I8X	338
R26V	1
I8W	2428
I8V	12185
R26T	11
R26S	113
I8T	2865
I8S	3836
R26Q	2
I8R	8471
I8Q	355
I8P	7347
R26N	4
I8N	756
I8M	10274
R26K	5104
I8L	23759
E48X	1
I8K	1704
R26I	119

E48V	23
R26G	117
I8H	1161
I8G	11455
R26E	6784
E48S	1
I8F	49002
A22Y	31
I8E	815
A22X	74
E48Q	12
R26C	1
A22W	570
I8D	381
E48P	3
I8C	5923
A22V	1280
R26A	2
E48N	6730
A22T	3327
I8A	5448
A22S	2062
A22R	8937
E48K	99
A22Q	255
A22P	3352
E48I	5186
A22N	708
E48G	57

A22M	134
A22L	883
E48D	150
A22K	181
A22I	78
A22H	490
E48A	49
A22G	727
A22F	103
A22E	1959
A22D	526
R26*	36
I8*	100
A21Y	517
A21X	361
A21W	13
A21V	1920
C30Y	34
A21T	11407
C30X	4
A21S	3034
C30W	110
A21R	10148
C30V	6760
A21Q	7
A21P	11992
E48*	30
C30S	67
C30R	64

A21N	330
A21M	744
A21L	1247
A21K	26
A21I	415
A22*	9
C30M	1
A21H	379
C30L	7
A21G	14051
A21F	200
A21E	329
A21D	99
A21C	6
C30G	126
C30F	126
A6Y	24
A6X	325
A6W	840
A6V	3659
A6T	453
A6S	807
A6R	8360
V13Y	2121
A6Q	145
A6P	2946
V13X	3870
V13W	685
A6N	7

A6M	42
V13T	2000
A6L	554
V13S	9585
A6K	53
V13R	159
V13Q	23
A6I	5
V13P	4283
A6H	118
A6G	52275
V13N	225
A6F	17
A6E	4551
V13M	81
V13L	4313
A6D	2429
A6C	44
V13K	55
A21*	31
V13I	1961
V13H	4806
V13G	3677
C30*	5088
V13F	14707
V13E	737
V13D	2992
V13C	481
V13A	12157

A6*	95
I34X	5
V13*	109
I34V	81
I34T	68
I34S	7057
I34R	2
I34P	5084
I34N	155
I34M	19
I34L	150
Q3Y	34
I34K	4
Q3X	374
Q3W	150
Q3V	143
I34H	10
Q3T	1746
I34F	33
Q3S	5993
Q3R	33876
I34C	1
Q3P	8363
Q3N	1051
Q3M	147
Q3L	2424
Q3K	7971
Q3I	42
Q3H	11346

Q3G	822
Q3F	5
Q3E	4026
Q3D	471
Q3C	236
Q3A	1989
Q3*	310
L11Y	190
L11X	514
L11W	7195
L11V	14823
L11T	2094
L11S	3732
V43X	1
L11R	25224
L11Q	1545
L11P	4684
L11N	194
L11M	5666
L11K	1613
L11I	869
L11H	2080
V43M	1
L11G	14067
V43L	6
L11F	2835
L11E	2683
L11D	4146
V43I	48

L11C	479
V43H	1
V43G	96
L11A	4395
V43F	11947
V43E	2
V43D	31
V43C	4
V43A	30
L11*	7137
T25X	27
T25V	1
T25S	74
T25R	6808
T25Q	8
T25P	299
T25M	45
T25L	1
T25K	86
T25G	2
T25E	4978
V41X	2
T25A	463
V41S	1
V41L	6738
V41I	30
V41G	56
V41F	68
V41E	1

V41D	23
V41C	5156
V41A	25
T25*	4
S49Y	58
S49X	1
S49T	119
S49R	5187
S49P	6808
S49N	2
S49L	1
S49H	1
S49G	1
S49F	60
S49C	10
S49A	262
I16Y	265
I16X	3812
I16W	2
I16V	1269
I16T	52882
I16S	15550
I16R	372
I16Q	8
I16P	7345
I16N	1802
I16M	164
I16L	9567
I16K	73

I16H	5277
I16G	51
I16F	4518
I16E	3
I16D	82
I16C	356
I16A	811
I16*	6
I14Y	485
I14X	3826
I14W	607
I14V	5437
I14T	4596
I14S	12235
I14R	3575
I14Q	14
I14P	1110
I14N	2301
I14M	3211
I14L	20774
I14K	6441
I14H	171
I14G	1412
I14F	31394
I14E	37
I14D	71
I14C	1418
I14A	667
I14*	341

I12Y	1079
I12X	482
I12W	2643
I12V	9956
I12T	12825
I12S	24472
I12R	10151
I12Q	838
I12P	3632
I12N	757
I12M	8093
I12L	18933
I12K	364
L29X	2
I12H	216
L29V	18
I12G	14335
I12F	20626
L29T	1
L29S	6763
I12E	486
L29R	207
I12D	88
I12C	5590
L29P	79
I12A	10191
R35X	3
L29I	68
L29H	90

L29G	2
R35S	1
L29F	30
R35Q	168
R35P	26
R35N	5084
L29A	3
R35L	69
R35H	1
R35G	19
R35E	6752
I12*	2175
R35D	3
V24Y	242
V24X	42
R35A	1
V24W	16
V24T	419
V24S	3150
V24R	3929
V24Q	649
V24P	3457
V24N	5841
V24M	19
V24L	1763
V24K	8
V24I	147
V24H	1108
V24G	939

V24F	431
V24E	112
V24D	285
V24C	138
V24A	319
R35*	62
V24*	7586
T39X	1
T39W	1
T39V	3
T39S	80
T39R	6773
T39Q	4
T39P	175
T39M	47
T39L	1
T39K	38
L23Y	1
L23X	10
L23W	6773
L23V	2945
T39G	5116
L23T	699
T39E	5
L23S	36
L23R	880
L23Q	172
H33Y	57
L23P	6430

T39A	276
H33X	5
L23M	932
H33T	6751
L23K	1580
H33S	5
M7Y	493
H33R	278
H33Q	95
L23I	939
M7X	159
M7W	8711
H33P	342
L23H	210
A18Y	5
A18X	3798
M7V	17044
L23G	5491
H33N	77
L23F	98
M7T	2797
L23E	856
A18V	57
H33L	107
M7S	5151
L23D	3
M7R	17064
A18T	318
H33K	2

L23C	50
M7Q	1096
A18S	74
M7P	4495
A18R	4826
L23A	168
H33I	1
A18P	6984
M7N	1235
M7L	27167
A18N	1
M7K	1912
H33D	12
A18L	2
M7I	5711
M7H	363
M7G	11714
M7F	2268
A18H	4
M7E	482
A18G	104
M7D	2714
M7C	2002
A18E	4
A18D	109
M7A	5540
L23*	37
M7*	7592
T36Y	1

T36X	2
T36W	5087
T36S	157
T36R	2
T36P	360
T36N	82
T36M	2
T36L	6759
T36K	1
T36I	40
T36H	1
T36G	1
T36D	3
T36C	1
T36A	376
T36*	2
E40X	1
E40W	1
E40V	49
E40S	18
E40R	6733
E40Q	7
E40K	57
E40G	5265
E40D	82
E40A	59
E40*	43
M1T	2061
M1S	29

M1R	65816
M1K	9962
M1I	11826
D28Y	89
D28V	824
D28T	6772
D28S	8
D28R	1
D28Q	1
D28P	5004
D28N	47
D28K	3
D28I	4
D28H	21
D28G	1240
A46X	2
D28F	5
D28E	162
F44Y	59
F44X	65
A46V	56
D28C	4
A46T	633
F44V	63
D28A	1447
A46S	53
F44S	6796
A46P	18
A46N	2

F44P	1
A46L	11915
F44N	2
A46K	1
F44L	164
F44I	41
A46G	38
F44H	5171
A46F	1
F44G	1
A46E	1
A46D	110
F44C	101
H4Y	1022
H4X	629
H4W	41
H4V	306
H4T	896
H4S	682
H4R	4119
F44*	1
H4Q	46515
H4P	1337
H4N	14709
H4M	270
H4L	4525
H4K	14108
H4I	7084
H4G	214

H4F	46
H4E	1897
H4D	1753
H4C	62
H4A	55
H4*	2287
Q38X	7
Q38V	1
Q38T	1
Q38S	4
Q38R	6838
Q38P	43
Q38N	7
Q38L	31
Q38K	124
Q38H	46
Q38G	3
Q38E	52
Q38D	5100
Q38C	1
A42X	3
A42W	1
C15Y	7296
A42V	323
C15X	3821
C15W	1448
A42T	124
C15V	9711
A42S	52

A42R	3
C15T	626
C15S	3397
A42P	4
C15R	4939
C15Q	118
C15P	2806
A42L	6732
C15N	142
C15L	2802
Q38*	75
C15K	551
A42G	43
C15I	106
C15H	6470
A42E	1
C15G	13446
A42D	59
C15F	16295
A42C	5161
C15E	4607
E31Y	2
C15D	401
E31X	5
E31W	3
E31V	67
C15A	853
E31S	14
E31R	6744

E31Q	14
E31N	1
E31K	66
E31G	5211
E31D	141
T17Y	1
T17X	3817
E31A	114
T17S	3433
C15*	3496
T17R	4813
T17P	51372
T17N	39
T17L	3
T17K	1
T17I	43
T17H	8
T17G	2
T17D	8
T17C	6
T17A	15882
E31*	70
K5Y	13
K5X	438
K5W	180
K5V	240
K5T	2657
K5S	496
K5R	103567

K5Q	1446
K5P	843
K5N	246
K5M	1214
K5L	272
K5I	13
K5H	94
K5G	10270
K5F	16
K5E	6297
K5D	42
V32Y	1
K5C	15
V32X	1
K5A	793
V32S	5061
V32N	1
V32M	1
V32L	37
V32I	73
K27X	88
V32G	124
V32F	6878
V32E	2
V32D	44
K27T	106
V32C	3
K27S	2
K27R	5101

V32A	35
K27Q	112
K5*	397
G37X	5
K27P	3
G37W	2
K27N	183
G37V	78
V9Y	352
K27M	1
V9X	190
G37T	1
V9W	30
G37S	66
G37R	15
K27I	28
V9T	987
G37P	5094
K27H	2
V9S	10631
K27G	1
V9R	5556
G37N	1
V9Q	459
K27E	74
V9P	7616
K27D	2
G37L	2
V9N	655

V9M	319
V9L	4822
V9K	459
G37F	1
V9I	966
G37D	848
V9H	870
V9G	30343
G37C	56
V32*	2
V9F	3555
V9E	2254
G37A	6774
V9D	2385
V9C	562
V9A	44989
K27*	40
K2Y	40
K2X	213
K2W	39
K2V	892

B)

Mutation	Occurrences
V9*	755
K2T	8207
Y47X	12
K2S	11657
K2R	24565

K2Q	2131
Y47T	9969
K2P	299
Y47S	111
K2N	5575
Y47R	6898
K2M	1199
K2L	318
Y47N	38
K2I	269
K2H	1122
Y47L	3
K2G	1089
K2F	1
K2E	2740
K2D	343
Y47H	33
K2C	110
Y47F	78
K2A	2997
Y47E	1
Y47D	49
Y47C	137
Y47A	1
K2*	935
Y47*	60
V20Y	1
V20X	10501
V20W	10082

V20T	1952
V20S	50
V20R	736
V20Q	18
V20P	4959
V20N	10
V20M	133
V20L	2199
V20I	14
V20H	8
V20G	9711
V20F	13
V20E	13320
V20D	183
V20C	34
V20A	7189
V19Y	400
V19X	8572
V19W	6
V19T	694
V19S	7130
V19R	45
V19Q	27
V19P	19209
V19N	6
V19M	3
V19L	391
V19K	4
V19I	1924

V20*	1
V19H	25
V19G	11908
V19F	555
V19E	90
V19D	11
V19C	34
V19A	5067
T45X	1
T45W	1
T45S	159
T45R	9997
T45Q	5
T45P	405
T45M	524
T45L	2
T45K	105
T45G	6893
V19*	10404
T45E	3
T45A	602
A10Y	655
E50X	2
A10X	3538
E50V	6917
A10W	1145
A10V	2240
A10T	4179
E50S	9965

A10S	5900
E50R	1
A10R	5950
E50Q	15
A10Q	305
E50P	1
A10P	46475
E50N	1
A10N	833
A10M	12
A10L	1976
E50K	88
A10K	1576
A10I	36
A10H	2290
E50G	86
A10G	21474
A10F	499
A10E	3506
E50D	49
A10D	2791
A10C	1624
E50A	33
E50*	31
A10*	375
R26X	1
I8Y	49
I8X	3497
R26V	3

I8W	417
I8V	8042
R26T	19
R26S	121
I8T	3087
I8S	2697
R26Q	2
I8R	4344
I8Q	97
I8P	5122
R26N	2
R26M	1
I8N	1151
I8M	9020
R26K	6748
E48Y	1
I8L	19153
I8K	1464
R26I	139
E48V	18
R26G	147
I8H	1688
I8G	7556
R26E	10012
I8F	25155
E48R	2
A22Y	1
R26D	1
A22X	4532

I8E	1495
E48Q	7
R26C	1
A22W	1305
I8D	614
E48P	1
I8C	6178
A22V	1234
R26A	2
E48N	9968
I8A	4502
A22T	2864
A22S	1753
A22R	12449
E48K	88
A22Q	116
E48I	6898
A22P	866
E48G	68
A22N	5
A22M	1526
A22L	429
E48D	181
A22K	126
A22I	52
A22H	2769
E48A	75
A22G	2201
A22F	454

A22E	247
A22D	1
R26*	39
I8*	142
A21Y	63
A21X	12960
A21W	500
A21V	6036
C30Y	51
A21T	2035
C30X	18
A21S	2701
C30W	133
C30V	10003
A21R	10122
A21Q	11
A21P	4218
E48*	39
C30S	78
C30R	76
A21N	6
A21M	5
A21L	4509
A21K	37
C30N	1
A22*	2606
A21I	29
A21H	3747
C30L	8

A21G	7469
A21F	380
A21E	1438
A21D	1478
C30G	167
A21C	2
C30F	101
C30E	1
A6Y	15
C30D	1
A6X	1221
A6W	526
A6V	3204
C30A	1
A6T	448
A6S	747
A6R	11288
A6Q	518
V13Y	628
A6P	2089
V13X	1183
V13W	419
A6N	7
A6M	290
V13T	1263
A6L	1034
V13S	13241
A6K	127
V13R	778

V13Q	114
A6I	2
V13P	4787
A6H	145
A6G	30582
V13N	1325
A6F	4
A6E	3888
V13M	1555
V13L	6108
A6D	3618
V13K	1007
A21*	3864
A6C	31
V13I	1984
V13H	6520
V13G	18395
C30*	6765
V13F	9562
V13E	3969
V13D	4914
V13C	1738
V13A	13043
A6*	229
I34X	1
V13*	92
I34V	88
I34T	80
I34S	10335

I34R	3
I34P	6760
I34N	194
I34M	18
I34L	161
Q3Y	29
I34K	3
Q3X	978
Q3W	923
Q3V	124
I34H	6
I34G	1
Q3T	1191
I34F	32
Q3S	9186
Q3R	21695
I34C	1
Q3P	5650
Q3N	507
Q3M	274
Q3L	2172
Q3K	6402
Q3I	25
Q3H	7237
Q3G	1059
Q3F	4
Q3E	3172
Q3D	338
Q3C	312

Q3A	3048
Q3*	451
L11Y	245
L11X	2389
L11W	5545
L11V	9196
L11T	2693
V43Y	1
L11S	1761
L11R	29759
V43W	1
L11Q	5527
L11P	9772
V43T	1
L11N	74
V43S	1
L11M	2533
L11K	2786
L11I	229
V43N	2
L11H	1517
L11G	16308
V43L	11
L11F	1107
V43K	1
L11E	3236
L11D	5811
V43I	43
L11C	276

V43G	100
L11A	2636
V43F	16905
V43E	2
V43D	33
V43C	6
V43A	26
L11*	13613
T25X	1211
T25W	1
T25V	2
T25S	121
T25R	10043
T25Q	9
T25P	321
T25M	48
T25L	1
T25K	94
T25G	1
T25E	6640
V41Y	4
T25D	1
V41X	4
V41W	2
T25A	359
V41S	2
V41M	1
V41L	9980
V41I	25

V41G	76
V41F	70
V41E	1
V41D	27
V41C	6855
V41A	25
T25*	2
S49Y	85
S49X	1
S49T	72
S49R	6898
S49P	10028
S49N	2
S49F	44
S49C	14
S49A	195
I16Y	164
I16X	101
I16W	4
I16V	1314
I16T	26982
I16S	15520
I16R	333
I16Q	8
I16P	3658
I16N	1604
I16M	213
I16L	6224
I16K	75

I16H	6675
I16G	47
I16F	3615
I16E	4
I16D	65
S49*	8
I16C	304
I16A	541
I16*	14
I14Y	409
I14X	251
I14W	1830
I14V	7014
I14T	7920
I14S	16992
I14R	10481
I14Q	490
I14P	5830
I14N	3376
I14M	3975
I14L	13087
I14K	1677
I14H	368
I14G	5702
I14F	16671
I14E	1848
I14D	2223
I14C	1787
I14A	3920

I14*	153
I12Y	1712
I12X	2135
I12W	2487
I12V	9998
I12T	10486
I12S	21608
I12R	16617
I12Q	1767
I12P	10841
I12N	2596
I12M	3574
I12L	10455
I12K	2126
L29Y	1
L29X	1
I12H	2487
L29V	30
I12G	14911
I12F	10518
L29T	1
L29S	10005
I12E	1921
I12D	1391
L29R	251
I12C	2810
L29Q	4
L29P	72
I12A	6497

L29N	1
R35Y	1
L29M	1
R35X	2
L29I	81
L29H	101
L29F	24
R35Q	139
R35P	16
L29C	2
R35N	6762
L29A	1
R35L	50
R35K	3
R35G	15
R35E	10000
I12*	3079
R35D	4
V24Y	9
V24X	1638
V24W	1903
V24T	2510
V24S	3992
V24R	403
V24Q	2
V24P	625
V24N	6725
V24M	4140
V24L	4003

V24K	308
V24I	916
V24H	135
V24G	546
V24F	5
V24E	475
V24D	186
V24C	2
V24A	3617
R35*	45
V24*	10796
T39W	1
T39S	95
T39R	10012
T39Q	1
T39P	203
T39M	47
T39L	2
T39K	49
L23X	1105
T39I	1
L23W	9991
T39G	6801
L23V	2440
L23T	65
T39E	4
L23S	478
L23R	3832
L23Q	247

H33Y	51
L23P	1303
T39A	285
H33X	1
H33V	1
L23M	3803
H33T	10005
L23K	7
H33S	2
M7Y	331
H33R	356
H33Q	91
M7X	1600
L23I	91
M7W	4613
H33P	321
L23H	63
M7V	9764
L23G	6994
A18X	73
L23F	512
H33N	113
M7T	2389
L23E	3770
A18V	34
M7S	2765
H33L	130
L23D	5
M7R	11193

A18T	306
H33K	4
L23C	53
M7Q	2276
A18S	194
M7P	2332
A18R	6396
L23A	1266
H33I	1
A18Q	1
A18P	10115
M7N	883
M7L	14968
A18N	1
M7K	1000
H33D	17
A18L	5
M7I	5724
M7H	368
M7G	10770
A18I	2
M7F	975
M7E	2361
A18G	152
M7D	5121
M7C	625
A18E	6
A18D	157
M7A	2413

A18C	1
L23*	5552
H33*	1
M7*	12027
T36W	6767
T36S	154
T36R	1
T36P	376
T36N	76
T36M	2
T36L	10004
T36I	27
T36H	3
T36F	1
T36D	2
T36C	1
T36A	476
T36*	3
E40X	2
E40V	35
E40S	14
E40R	9969
E40Q	10
E40N	1
E40M	1
E40L	1
E40K	51
E40G	6990
E40D	62

E40A	66
E40*	47
M1T	1768
M1S	39
M1R	43423
M1K	6743
M1I	10860
D28Y	122
D28X	25
D28V	983
D28T	10006
D28S	10
D28R	1
D28Q	2
D28P	6680
D28N	65
D28L	1
D28K	2
D28I	3
D28H	15
D28G	1572
D28F	8
D28E	195
F44Y	55
A46V	45
F44X	80
D28C	15
A46T	480
F44V	70

D28A	1698
A46S	71
F44S	10021
A46P	12
F44R	1
F44Q	1
A46N	2
A46L	16864
F44N	3
F44L	164
A46G	44
F44I	49
F44H	6885
F44G	1
A46D	107
F44C	118
H4Y	635
H4X	1493
H4W	488
H4V	183
H4T	417
H4S	577
H4R	3714
F44*	4
H4Q	28009
H4P	2020
H4N	9810
H4M	193
H4L	3542

H4K	7321
H4I	10003
H4G	304
H4F	35
H4E	1458
H4D	2503
H4C	184
H4A	90
H4*	3348
Q38X	8
Q38W	1
Q38T	1
Q38S	6
Q38R	10054
Q38P	44
Q38N	5
Q38L	13
Q38K	102
Q38I	1
Q38H	36
Q38E	51
Q38D	6791
Q38A	1
A42X	2
A42W	1
C15Y	10383
A42V	267
C15X	238
A42T	78

C15W	5157
C15V	13566
A42S	42
A42R	6
C15T	780
C15S	6745
A42P	8
C15R	9394
C15Q	478
C15P	5533
A42L	9973
C15N	1267
C15L	1684
Q38*	56
C15K	3366
A42H	1
A42G	46
C15I	86
A42F	1
C15H	649
C15G	18155
A42D	72
C15F	8680
A42C	6868
C15E	2738
E31Y	3
C15D	2236
E31X	18
E31W	4

E31V	45
C15A	2268
E31S	7
E31R	9990
E31Q	8
E31N	1
E31M	1
E31K	70
E31G	6875
E31D	174
T17Y	3
T17X	93
E31C	1
E31A	129
T17V	2
C15*	5173
T17S	3286
T17R	6382
T17P	36194
T17N	43
T17L	2
T17I	47
T17H	12
T17G	5
T17D	8
T17C	7
T17A	12562
E31*	83
K5Y	3

K5X	1634
K5W	263
K5V	409
K5T	2455
K5S	503
K5R	67004
K5Q	1174
K5P	301
K5N	310
K5M	1170
K5L	474
K5I	15
K5H	25
K5G	9493
K5F	2
K5E	4797
K5D	491
V32Y	1
K5C	12
K5A	357
V32T	1
V32S	6734
V32N	1
V32M	3
V32L	48
V32I	87
K27X	1555
V32G	163
V32F	10155

V32E	1
K27V	1
V32D	47
K27T	168
V32C	3
K27S	5
K27R	6813
V32A	36
K27Q	113
K5*	369
K27P	3
G37X	1
G37W	2
K27N	176
G37V	57
V9Y	163
K27M	1
V9X	3619
G37T	1
K27L	1
G37S	60
V9W	24
G37R	14
K27I	38
G37P	6779
V9T	261
K27H	1
V9S	11973
K27G	1

V9R	6370
V9Q	54
K27E	101
V9P	7498
K27D	2
G37L	1
V9N	380
V9M	43
V9L	1888
V9K	398
G37F	1
V9I	319
G37E	3
V9H	657
G37D	730
V9G	22030
G37C	52
V9F	1821
V9E	3590
G37A	10018
V9D	2873
V9C	470
V9A	27269
K27*	34
K2Y	49
K2X	527
K2W	43
K2V	105

* represents a mutation that rendered a stop mutation. X is a mutation that rendered an indel. The mutation is described following the format [wild-type residue][position][mutated residue]; the residues are specified by a one-letter code.

Table S4. Single-residue mutations on the TM region of HokC.

Position	Tolerance	Intolerance	Substitutions in the alignment
M1	R,K,I		A,M
K2	T,S,R,Q,N,E	M	M,N,T,P,S,I,K,L,Q,W
Q3	R,P,N,K,H,E	L	Q,R,P,S
H4	R,Q,P,N,L,K,I,E,D	Y	Q,L,N,R,H,G,A
K5	T,R,Q,P,N,M,G,E		K,H,R,Q,N,S
A6	V,S,P,G,E	T	V,T,P,S,C,Y,A,I
M7	V,T,R,L,I	W,K	M,G,R,V,I,F,A,L
I8	V,T,S,R,P,N,M,L,G,F,D,C		I,V,L,S
V9	Y,S,I,G,F,D,C,A		V,M,G,W,L,A,F,I
A10	V,T,S,R,P,G,F,D,C		T,S,M,G,A,I,C
L11	W,V,R,Q,M,G,F,A	P	L,T,V,A,I
I12	W,V,T,R,P,N,M,L,K,G,F	S,D,C	G,F,I,V,L
V13	P,L,G,F,D,A	I	A,M,I,V,T
I14	Y,V,T,R,N,M,L,F,A	S,P	M,F,I,V,L,S
C15	Y,W,S,R,P,G,F,E,A		C
I16	V,T,S,N,M,L,F		C,F,I,A,M,V,L
T17	S,P,I,A		T
A18	V,T,S,P,D	G	I,A,M,V,L
V19	Y,Q,P,I,F,A	L,G	I,L,V,P
V20	P,M,L,G,A		F,I,L,M,G,C,V,T,S
A21	W,V,S,P,G,E	T	F,I,A,T,L
A22	V,R,Q,P,N,G	T,S	V,T,L,S,A,I
L23	V,T,Q,P,M,I		Y,L,W,F,C

V24	Y,S,R,L,I,G,A	V,L,I,M
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Amino acid residue names are represented using the one-letter codes. Every amino acid and its position are indicated in the Position column. Mutations rendering “Wild-type Phenotype” or “Mutant Phenotype” are shown in columns labeled “Tolerance” and “Intolerance”, respectively. For instance, position V13 presents 6 mutations (for amino acids P, L, G, F, D, A) rendering a wild-type phenotype and 1 mutation (V13I) rendering a mutant phenotype. It may be noticed that all positions tolerate most substitutions (Tolerance/Intolerance > 1). The last column show the substitutions observed for every position in the multiple sequence alignment (MSA) generated with TCOFFEE (see Methods); the letters in bold in this last column mark mutations identified in our experimental mutagenesis.

Table S5. Multiple mutations in HokC with wild type phenotype.

Mutation	Count
M7W,I12S	613
I12S,I14S	317
L11P,I12S	276
M7W,I12C	221
M7W,I14S	220
M7W,L11P	184
I12S,V19G	145
I12S,A22T	136
I12S,V13I	99
I12C,I14S	80
M7W,A22T	79
I12S,I14P	74
I14S,V19G	72
M7W,V19G	71
I12S,A22S	70
L11P,I14S	66
I12S,V19L	64

Q3L,I12S	60
M7W,V13I	49
M7W,I14P	48
K2M,I12S	44
I12S,A21T	44
M7K,I12S	42
I12C,A22T	39
V13I,I14S	38
I12C,V13I	37
I14S,A22T	36
H4Y,I12S	36
M7W,A22S	33
M7W,I12S,I14S	31
I12C,V19G	30
I14S,V19L	28
H4Y,M7W	28
V13I,V19G	26
Q3L,I12C	26
M7K,I14S	25
I12C,A22S	25
Q3L,M7W	24
A6T,I12S	24
Q3L,I14S	23
K2M,M7W	23
V19L,A21T	22
L11P,V19G	22
L11P,V13I	22
L11P,I14P	22
I14S,A21T	22
I12C,I14P	21

H4Y,I12C	21
K2M,V19G	20
A18G,V19G	20
V13I,A22T	19
Q3L,V13I	19
Q3L,L11P	18
K2M,Q3L	18
V13I,A22S	17
L11P,I12C	17
K2M,H4Y	17
Q3L,V19L	16
K2M,V19L	16
I14S,A22S	16
Q3L,A21T	15
K2M,I14S	15
K2M,I12C	15
H4Y,I14S	15
M7K,V19L	14
M7K,V13I	14
V13I,V19L	13
Q3L,V19G	13
M7W,V19L	13
M7K,V19G	13
I12C,V19L	13
H4Y,V13I	13
Q3L,H4Y	11
M7W,I12C,I14S	11
H4Y,L11P	11
M7W,L11P,I12S	10
L11P,V19L	10

K2M,V13I	10
A6T,I14S	10
V13I,A21T	9
M7K,L11P	9
M7K,A22T	9
I12C,A21T	9
H4Y,A22T	9
M7K,I12C	8
L11P,A22S	8
L11P,A21T	8
K2M,L11P	8
I12S,I14S,V19G	8
A6T,I12C	8
A6T,A21T	8
V19L,A22T	7
M7W,I12S,V13I	7
M7W,A21T	7
L11P,I12S,I14S	7
K2M,I14P	7
H4Y,V19G	7
A6T,V19G	7
A6T,V13I	7
Q3L,I14P	6
Q3L,A22T	6
Q3L,A22S	6
M7W,I12S,A22T	6
M7K,A21T	6
L11P,A22T	6
I12S,V13I,I14S	6
H4Y,M7W,I14S	6

H4Y,A22S	6
A6T,L11P	6
V19L,A22S	5
Q3L,M7K	5
M7W,L11P,I14S	5
M7W,I12C,V13I	5
L11P,I12S,V19G	5
K2M,M7K	5
I14P,V19G	5
I12S,I14S,A22T	5
I12S,A18G	5
V13I,I14P	4
Q3L,A6T	4
M7W,L11P,V13I	4
M7W,I12S,I14P	4
M7W,I12C,A22T	4
L11P,I12S,V13I	4
K2M,I12S,I14S	4
K2M,A22S	4
H4Y,V19L	4
H4Y,I14P	4
A6T,M7W	4
A6T,I14P	4
A6T,A22T	4
A6T,A22S	4
V19G,A21T	3
Q3L,M7W,I12C	3
Q3L,L11P,I12S	3
Q3L,I12S,V13I	3
Q3L,I12S,I14S	3

M7W,V13I,I14S	3
M7W,I12S,V19G	3
M7W,I12S,A22S	3
M7W,I12C,V19G	3
M7K,I14P	3
M7K,A22S	3
M7K,A18G,V19G	3
K2M,M7W,I12S	3
K2M,A22T	3
K2M,A21T	3
I14S,A18G	3
I12S,V13I,A21T	3
I12S,I14S,V19L	3
I12D,V13I	3
I12C,V13I,I14S	3
H4Y,M7W,I12S	3
H4Y,A21T	3
A6T,M7W,I12S	3
A6T,I12S,I14S	3
A21T,A22T	3
V19G,A22S	2
V13I,I14S,A22T	2
Q3L,V13I,I14S	2
Q3L,M7W,I14S	2
Q3L,M7W,I12S	2
Q3L,L11P,V19G	2
Q3L,I12S,V19G	2
Q3L,A18G	2
M7W,I14S,V19G	2
M7W,I14S,A22T	2

M7W,I14S,A22S	2
M7W,I12D	2
M7K,V13I,A21T	2
M7K,A18G	2
L11P,I12S,V19L	2
K2M,M7W,L11P	2
I14P,A22S	2
I12D,I14S	2
H4Y,M7K	2
H4Y,I12S,I14S	2
H4Y,I12S,A22T	2
H4Y,A6T	2
A6T,V19L	2
A6T,M7K	2
A6T,I12S,V13I	2
A18G,V19L	2
A18G,A22S	2
V19G,A22T	1
V13I,I14S,V19L	1
V13I,I14S,A22S	1
V13I,A18G	1
Q3L,V19L,A21T	1
Q3L,V13I,V19L	1
Q3L,M7W,V19L	1
Q3L,M7W,V13I	1
Q3L,M7W,L11P	1
Q3L,M7W,I12S,I14S	1
Q3L,M7W,A22T	1
Q3L,M7K,L11P	1
Q3L,M7K,I14S	1

Q3L,M7K,I12S	1
Q3L,L11P,V13I	1
Q3L,I14S,A21T	1
Q3L,I12S,A21T	1
Q3L,I12C,V19L	1
Q3L,I12C,V19G	1
Q3L,H4Y,M7W,I12S	1
Q3L,H4Y,I12C	1
Q3L,H4Y,A22T	1
Q3L,A6T,M7K	1
Q3L,A6T,I12S	1
Q3L,A6T,I12D	1
M7W,V13I,I14P	1
M7W,V13I,A22T	1
M7W,L11P,V19G	1
M7W,L11P,I14P	1
M7W,L11P,A22T	1
M7W,I12S,V19L	1
M7W,I12S,V13I,A22T	1
M7W,I12S,I14S,A22T	1
M7W,I12S,A18G	1
M7W,I12D,V19G	1
M7W,I12C,V19L	1
M7W,I12C,I14P	1
M7W,I12C,A22S	1
M7W,A21T,A22S	1
M7K,V13I,A22S	1
M7K,L11P,I12S	1
M7K,I14S,V19G	1
M7K,I12S,V19L	1

M7K,I12S,V13I	1
M7K,I12S,A21T	1
M7K,I12D	1
M7K,I12C,V13I	1
L11P,V19L,A22S	1
L11P,V13I,V19G	1
L11P,V13I,I14S	1
L11P,I14S,V19G	1
L11P,I12S,V13I,I14S	1
L11P,I12S,I14P	1
L11P,I12D,V13I	1
L11P,I12D	1
L11P,A18G,V19G	1
K2M,V13I,A22S	1
K2M,Q3L,V19L	1
K2M,Q3L,I12S,V19G	1
K2M,Q3L,H4Y,V19L	1
K2M,Q3L,A21T	1
K2M,M7W,V19G	1
K2M,M7W,I14S	1
K2M,M7W,I12C	1
K2M,L11P,I14S	1
K2M,L11P,I14P	1
K2M,I14S,V19L	1
K2M,I12S,V19L	1
K2M,I12S,V19G	1
K2M,I12S,I14S,V19G	1
K2M,I12S,A21T	1
K2M,I12D	1
K2M,I12C,V13I	1

K2M,I12C,I14S	1
K2M,I12C,I14P	1
K2M,H4Y,V19L	1
K2M,H4Y,V19G	1
K2M,H4Y,V13I	1
K2M,H4Y,L11P	1
K2M,H4Y,I12S	1
K2M,H4Y,I12C	1
K2M,H4Y,A21T	1
K2M,A6T,A22T	1
K2M,A6T	1
I14S,V19L,A21T	1
I14S,A18G,V19G	1
I14P,V19L	1
I14P,A22T	1
I12S,V19L,A22T	1
I12S,V19L,A21T	1
I12S,V13I,A22S	1
I12S,I14S,A22S	1
I12S,A18G,V19G	1
I12D,V19L	1
I12D,V19G	1
I12D,I14P	1
I12D,A22T	1
I12D,A21T	1
I12C,I14P,V19G	1
H4Y,V13I,A22S	1
H4Y,M7W,L11P	1
H4Y,L11P,I14S	1
H4Y,L11P,I12S,V19G	1

H4Y,L11P,I12D,V13I	1
H4Y,I12S,V19G	1
H4Y,I12S,V13I	1
H4Y,A6T,V13I	1
A6T,V13I,A22T	1
A6T,V13I,A22S	1
A6T,L11P,V13I	1
A6T,L11P,I14S	1
A6T,L11P,I12S	1
A6T,I12S,I14S,V19G	1
A6T,I12S,I14P	1
A6T,I12S,A22S	1
A6T,I12S,A21T	1
A6T,I12D,V13I	1
A6T,I12C,A22S	1
A6T,A18G	1
A18G,A21T	1

Table S6. Occurrence of deleterious single-point mutations in compensatory mutations.

Intolerated single-point mutation	Occurrence
K2M	46
Q3L	51
H4Y	39
A6T	36
M7K	30
M7W	65
L11P	52
I12C	35

I12D	16
I12S	79
V13I	58
I14P	24
I14S	59
A18G	15
V19G	43
V19L	36
A21T	29
A22T	31
A22S	29

The value Occurrence reports the number of multiple compensatory mutations that presented the particular single-point mutation reported in column labeled “Intolerated single-point mutation”.

Table S7. Multiple sequence alignment of 148 protein sequences from PF01848 family obtained with TM-COFFEE.

IN	HEL	OUT
HOKC_ECOLI	-----	MK
F3VWM0_SHIBO	-----	MS
H5R5N6_ECOLX	-----	ML
C6UVK1_ECO5T	-----	ML
HOKF_ECO57	M-----	L
H4V506_ECOLX	M-----	L
E2QGR9_ECOLX	-----	MP
D6J7Q5_ECOLX	-----	ML
F4TJV8_ECOLX	M-----	L
G0F2P1_ECOLX	-----	MP
G1Z0S1_ECOLX	M-----	L
G1YEQ3_ECOLX	M-----	L
F9CTD1_ECOLX	-----	MS
H4IYN1_ECOLX	-----	MP
F5NNJ6_SHIFL	-----	MP
E1J5E3_ECOLX	-----	ML
B7N6Z5_ECOLU	M-----	L
H1FMW9_ECOLX	-----	ML
F9CSC2_ECOLX	-----	AM
H8D654_ECOLX	-----	ML
E9TXJ2_ECOLX	-----	ML
H5J5L9_ECOLX	M-----	L
H5NSR7_ECOLX	-----	MS
E2X956_SHIDY	-----	ML
D8E1P5_ECOLX	M-----	L
H5PSJ3_ECOLX	-----	MP
D2AAD3_SHIF2	-----	MP
H1DN41_ECOLX	MKPQDDISINF-----	GAATPNQTIWMVVPSSSHGGNINML
E9VJD7_ECOLX	-----	ML
E9TYV6_ECOLX	-----	MQ

F4UN92	ECOLX	-----	MKYLNTTDCSLFLAERSK
F8XK11	ECOLX	-----	ML
G1ZVT9	ECOLX	-----	ML
E9Y7R9	ECOLX	-----	M
H4LZX6	ECOLX	-----	MP
D6HWC9	ECOLX	-----	ML
E2KHD1	ECO57	-----	ML
F9S7G0	9VIBR	-----	MP
G5W2A4	ECOLX	-----	MS
E8HUC2	ECOLX	-----	MK
HOKD	ECO57	-----	MK
B2U569	SHIB3	-----	MP
H9YDF6	ECOKO	-----	MP
E1IYD1	ECOLX	-----	MK
G2FAK9	ECOLX	-----	ML
E9XTT2	ECOLX	-----	MW
E8II98	ECOLX	MPEAFRFQVYSEVWKDEAPGDISINPGAATPNQTIWMVVPSSHGGNINML	
G5Y5U9	ECOLX	-----	ML
B3HJT0	ECOLX	-----	ML
E9U427	ECOLX	-----	ML
D8E8Z0	ECOLX	MKPQEIFLSIL-----GLPLRASTTRMVVPSSHGGNINML	
G2S0L6	ENTAL	-----	MT
H5JJ49	ECOLX	-----	MS
E1PB25	ECOAB	MVV-----PSSHGGNINML	
H5GVQ2	ECOLX	M-----	L
E7HA11	ECOLX	-----	MP
G8XCJ0	KLEPN	-----	MK
H4JR53	ECOLX	M-----	L
G5XXC8	ECOLX	-----	MS
Q3Z5Z9	SHISS	-----	ML
E0IZ09	ECOLW	-----	ML
G5KK22	ECOLX	-----	ML
H6MBN5	ECOLX	-----	MK
D5CWF7	ECOKI	-----	ML
B2TD6	SHIB3	MKPQEIFLSIL-----GLPLRASTTRMVVPSSHGGNINML	
D3H5D3	ECO44	-----	MK
D6J6E3	ECOLX	-----	ML
F5VK79	ENTSA	-----	MK
B6ZP83	ECO57	M-----	L
B3I927	ECOLX	M-----	L
H5FWT6	ECOLX	-----	MS
H5BXU3	ECOLX	-----	MP
G5W9P6	ECOLX	M-----	L
D6IMK6	ECOLX	-----	MK
H4Q809	ECOLX	-----	MP
E5B936	ERWAM	-----	MK
D8C2A4	ECOLX	-----	MP
F9HSF5	ECOLX	-----	
E8YBF8	ECOKO	-----	MK
H6MHP8	ECOLX	M-----	L
F4VXG3	ECOLX	-----	MN
E1IRH6	ECOLX	-----	ML
H5NFB4	ECOLX	-----	MP
H7CRD5	ECO57	-----	MK
F1XMB4	ECO57	-----	MP
E8I9N6	ECOLX	-----	MK
C8TWH1	ECO26	-----	MKYLNTTDCSLFLAERSK
E1IQK3	ECOLX	M-----	L
B2NP37	ECO57	-----	MP
D6GL38	9ENTR	MHEHHKSS-----LLLVENQHWRRGMP	
G5TUD2	ECOLX	-----	ML
E7TAB1	SHIFL	-----	M
E9Y8K4	ECOLX	-----	MI
H1F377	ECOLX	-----	ML
F8XED9	ECOLX	-----	MP
F7MUV5	ECOLX	-----	MS
H4NJR3	ECOLX	-----	MP
H4KT12	ECOLX	-----	MK
H1FAP9	ECOLX	-----	ML
F9CEP4	ECOLX	-----	ML
B2U6D2	ECOLX	-----	MK
B6ZRV0	ECO57	-----	MP
B3X849	ECOLX	-----	MP
E1IOA5	ECOLX	-----	MK
H5A0H9	ECOLX	M-----	L
G5X3P4	ECOLX	-----	ML
H5KI64	ECOLX	M-----	L

G5WI34	ECOLX	-----	MM
F3Q9V6	9ENTR	-----	-----
D8B2D1	ECOLX	-----	MN
E9VCC9	ECOLX	-----	MK
H5AV32	ECOLX	-----	MS
F3V7U1	SHIDY	-----	MS
E9Y8K6	ECOLX	MGL-----PLQTRTIWMVVPSSHGGNINML	-----
H4YAG3	ECOLX	-----	-----
E1IRH4	ECOLX	MKPQEIFLSII-----GLPLRASTTRMVVPSSHGGNINML	-----
G5UXX9	ECOLX	MPEHHKVS-----LLLVGNQHRGLGMP	-----
C6UR89	ECO5T	-----	ML
Q0H0B2	ECOLX	-----	M
C8SY02	KLEPR	-----	ML
H5H178	ECOLX	-----	MK
C8TPL3	ECO26	-----	ML
H9YME7	ECOKO	-----	ML
G5XGE5	ECOLX	M-----L	L
Q8Z607	SALTI	-----	MK
I0QXL4	9ENTR	-----	MP
G5WKB9	ECOLX	MPEHHKVS-----LLLVGNQHRGLGMP	-----
F4UZC8	ECOLX	MKPQDDISINP-----GAATPNQTIWMVVPSSHGGNINML	-----
H3M9M9	KLEOX	MNLNNSDV-----SLFF-----AGRQDML	-----
B3H9D0	ECOLX	-----	MS
F1XSU4	ECO57	M-----L	L
D3RCX9	KLEVT	-----	MP
H4FPV2	ECOLX	-----	ML
F9CJU5	ECOLX	-----	MS
H5JUR0	ECOLX	-----	ML
H5AS66	ECOLX	-----	MP
C8UQU5	ECO1A	-----	ML
G5X8B3	ECOLX	-----	MS
H4MLQ7	ECOLX	M-----L	L
E7JA92	ECOLX	MPEHHKVS-----LLLVGNQHRGLGMP	-----
G0GSM6	KLEPN	M-----L	L
G9RE52	9ENTR	M-----L	L
H5CWM5	ECOLX	-----	MK
G7RV84	KLEPN	-----	MK
HOKC	SHIFL	-----	MK
B3AGC6	ECO57	-----	MP
H8WUZ6	SALTS	-----	-----
B5R4Z4	SALEP	-----	ML
E8H236	ECO57	-----	MK
G2AM71	ECOLX	-----	MP

HOKC	ECOLI	-----	QHKA
F3VVM0	SHIBO	-----	Q-KS
H5R5N6	ECOLX	-T-----	-KY
C6UVK1	ECO5T	-NTC-----R-VPLTDRKVKEKRAMK-QHKV	-----
HOKF	ECO57	-T-----	-KY
H4V506	ECOLX	-T-----	-KY
E2QGR9	ECOLX	-Q-----	-KY
D6J7Q5	ECOLX	-T-----	-KY
F4TJV8	ECOLX	-T-----	-KY
G0F2P1	ECOLX	-Q-----	-KY
G1Z0S1	ECOLX	-T-----	-KY
G1YEQ3	ECOLX	-T-----	-KY
F9CTD1	ECOLX	-----	Q-KS
H4IYN1	ECOLX	-Q-----	-KY
F5NNJ6	SHIFL	-Q-----	-KY
E1J5E3	ECOLX	-NTC-----R-VPLTDRKVKEKRAMK-QHKA	-----
B7N6Z5	ECOLU	-T-----	-KY
H1FMW9	ECOLX	-T-----	-KY
F9CSC2	ECOLX	-----	SQKS
H8D654	ECOLX	-T-----	-KY
E9TXJ2	ECOLX	-HKRR-----LASYPEKGEKQAMK-QQKA	-----
H5J5L9	ECOLX	-T-----	-KY
H5NSR7	ECOLX	-----	Q-KS
E2X956	SHIDY	-T-----	-KY
D8E1P5	ECOLX	-T-----	-KY
H5PSJ3	ECOLX	-Q-----	-KY
D2AAD3	SHIF2	-Q-----	-KY
H1DN41	ECOLX	-T-----	-KY
E9VJD7	ECOLX	-T-----	-KY
E9TVV6	ECOLX	-NTC-----R-VPLTDRKVKEKRAMK-QHKA	-----
F4UN92	ECOLX	FMT-----	-KY

F8XK11_ECOLX	--YTRR--	LASYVPGKGEKQAMK-QQKA	----
G1ZVT9_ECOLX	-T-	-KY	----
E9Y7R9_ECOLX	-----	PQRT	----
H4LZX6_ECOLX	-Q-	-KY	----
D6HWC9_ECOLX	-CTCR-	LASYAPEGKEKQAMK-QQKA	----
E2KHD1_ECO57	-T-	-KY	----
F9S7G0_9VIBR	-----	RNKT	----
G5W2A4_ECOLX	-HKCR-	LASYVPGKGKQAMK-QQKA	----
E8HUC2_ECOLX	-----	QHKV	----
HOKD_ECO57	-----	QQKA	----
B2U569_SHIB3	-Q-	-KY	----
H9YDF6_ECOKO	-Q-	-KY	----
E1IYD1_ECOLX	-----	HNP	----
G2FAK9_ECOLX	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
E9XTT2_ECOLX	-QDKSPVVNFSLTHEAPACLDNIR-	IASYRALRKEKKAMKLPSS	----
E8II98_ECOLX	-T-	-KY	----
G5Y5U9_ECOLX	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
B3HJT0_ECOLX	-T-	-KY	----
E9U427_ECOLX	-T-	-KY	----
D8E8Z0_ECOLX	-T-	-KY	----
G2S0L6_ENTAL	-----	PLKT	----
H5JJ49_ECOLX	-----	Q-KS	----
E1PB25_ECOAB	-T-	-KY	----
H5GVQ2_ECOLX	-T-	-KY	----
E7HA11_ECOLX	-----	Q-KT	----
G8XCJ0_KLEPN	-----	LPRNT	----
H4JR53_ECOLX	-T-	-KY	----
G5XXC8_ECOLX	-----	Q-KS	----
Q3Z5Z9_SHISS	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
E0IZ09_ECOLW	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
G5KK22_ECOLX	-T-	-KY	----
H6MBN5_ECOLX	-----	QQKA	----
D5CWF7_ECOKI	-T-	-KY	----
B2TTD6_SHIB3	-T-	-KY	----
D3H5D3_ECO44	-L-	PGNA	----
D6J6E3_ECOLX	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
F5VK79_ENTSA	-----	PLHY	----
B6ZP83_ECO57	-T-	-KY	----
B3I927_ECOLX	-T-	-KY	----
H5FWT6_ECOLX	-----	Q-KS	----
H5BXU3_ECOLX	-Q-	-KY	----
G5W9P6_ECOLX	-T-	-KY	----
D6IMK6_ECOLX	-----	QQKA	----
H4Q809_ECOLX	-Q-	-KY	----
E5B936_ERWAM	-----	LPANC	----
D8C2A4_ECOLX	-Q-	-KY	----
F9HSF5_ECOLX	-----	-----	----
E8YBF8_ECOKO	-Q-	QKA	----
H6MHP8_ECOLX	-T-	-KY	----
F4VXG3_ECOLX	-GKSR-	LASYVPGKGEKQAMK-QQKA	----
E1IRH6_ECOLX	-T-	-KY	----
H5NFFV4_ECOLX	-Q-	-KY	----
H7CRD5_ECO57	-----	LPRSS	----
F1XMB4_ECO57	-----	Q-KT	----
E8I9N6_ECOLX	-----	QQKA	----
C8TWH1_ECO26	FMT	-KY	----
E1IQK3_ECOLX	-T-	-KY	----
B2NP37_ECO57	-----	Q-KT	----
D6GL38_9ENTR	-Q-	-KY	----
G5TUD2_ECOLX	-T-	-KY	----
E7TAB1_SHIFL	-----	K-QHKA	----
E9Y8K4_ECOLX	-FYYQ-	PEAPYMLNTCR-VPLTDRKVKEKRAMK-QHKA	----
H1F377_ECOLX	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
F8XED9_ECOLX	-Q-	-KY	----
F7MUV5_ECOLX	-----	Q-KS	----
H4NJR3_ECOLX	-----	Q-KT	----
H4KT12_ECOLX	-----	QHKA	----
H1FAP9_ECOLX	-DTCR-	LASYVPGKGEKQAMK-QQKA	----
F9CEP4_ECOLX	-T-	-KY	----
B2U6D2_ECOLX	-L-	PGNA	----
B6ZRV0_ECO57	-Q-	-KY	----
B3X849_ECOLX	-Q-	-KY	----
E1IOA5_ECOLX	-----	HNP	----
H5A0H9_ECOLX	-T-	-KY	----
G5X3P4_ECOLX	-NTC-	-R-VPLTDRKVKEKRAMK-QHKA	----
H5KI64_ECOLX	-T-	-KY	----
G5WI34_ECOLX	-----	PQRT	----

F3Q9V6_9ENTR	-----	-----
D8B2D1_ECOLX	--GKSR--	LASYVPKGKEKQAMK-QQKA
E9VCC9_ECOLX	-----	QHKA
H5AV32_ECOLX	-----	Q-KS
F3V7U1_SHIDY	-----	Q-KS
E9Y8K6_ECOLX	-T-	KY
H4YAG3_ECOLX	-----	-----
E1IRH4_ECOLX	-T-	KY
G5UXX9_ECOLX	Q	KY
C6UR89_ECO5T	-DTCR--	LASYAPKGKEKQAMK-QQKA
Q0H0B2_ECOLX	-T-	KY
C8SY02_KLEPR	-HQHQVTPLLT-	LRYLQYLCELTQEKKAMKLPRNA
H5H178_ECOLX	-----	QHKA
C8TPL3_ECO26	-HKRR--	LASYAPKGKEKQVMK-QQKA
H9YME7_ECOKO	-T-	KY
G5XGE5_ECOLX	-T-	KY
Q8Z607_SALTI	Q	QKA
I0QXL4_9ENTR	-T-	NIKVAPHLKRGKHAMNSLM
G5WKB9_ECOLX	Q	KY
F4UZC8_ECOLX	-T-	KY
H3M9M9_KLEOX	-T-	KY
B3H9D0_ECOLX	-----	Q-KS
F1XSU4_ECO57	-T-	KY
D3RCX9_KLEVT	Q	KY
H4FPV2_ECOLX	-NTC-	R-VPLTDRKVKEKRAMK-QHKA
F9CJU5_ECOLX	-----	Q-KS
H5JUR0_ECOLX	-T-	KY
H5AS66_ECOLX	-----	Q-KT
C8UQU5_ECO1A	-VTFRVA-	SYPLKCKEKKAMKLPNQP
G5X8B3_ECOLX	-----	Q-KS
H4MLQ7_ECOLX	-T-	KY
E7JA92_ECOLX	Q	KY
G0GSM6_KLEPN	-T-	KY
G9RE52_9ENTR	-T-	KY
H5CWM5_ECOLX	-----	QHKA
G7RV84_KLEPN	-----	LPRNT
HOKC_SHIFL	-----	QHKA
B3AGC6_ECO57	Q	KY
H8WUZ6_SALTS	-----	-----
B5R4Z4_SALEP	-CTCR--	LASYVPKGKEKQAMK-QQKA
E8H236_ECO57	-----	QHKV
G2AM71_ECOLX	Q	KY

HOKC_ECOLI	-MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-
F3VWM0_SHIBO	-L--TAITFCVTAILIIWMLHGSLCEIRMSFWGAEFAAFLQCK---Q-
H5R5N6_ECOLX	-ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKVVLAYEPK
C6UVK1_ECO5T	-MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-
HOKF_ECO57	-ALVAVIVLCLTVPGFTLLVGDSLCEFTVKERNIEFRAVLAYEPK
H4V506_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
E2QGR9_ECOLX	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLACKLKE
D6J7Q5_ECOLX	-ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
F4TJV8_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
G0F2P1_ECOLX	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLACKLKE
G120S1_ECOLX	-ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
G1YEQ3_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
F9CTD1_ECOLX	-L--ITVTICMTVIFTIWMMLHGSLCEFRNLWGAEFAAFLQCK---Q-
H4IYN1_ECOLX	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLACKLKE
F5NNJ6_SHIFL	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLAYKLKE
E1J5E3_ECOLX	-MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-
B7N6Z5_ECOLU	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
H1FMW9_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
F9CSC2_ECOLX	-L--TAIMFCVTVILIIWMLHGSLCEIRMSFWGAEFAAFLQCK---Q-
H8D654_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
E9TXJ2_ECOLX	-MLIALIVICLTVIVTALVTRKDLCEVRIRITGQTEVAVFTA
H5J5L9_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
H5NSR7_ECOLX	-L--TAITSCVTAILIIWMLHGSLCEIRMSFWGAEFAAFLQCK---Q-
E2X956_SHIDY	-ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLTYPK
D8E1P5_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCELSIRERGMEFKAVLAYESK
H5PSJ3_ECOLX	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLACNLK
D2AAD3_SHIF2	-RLLSLIVICFTLLFFTWMIRDSDLCELHIKQESYELAAFLAYKLKE
H1DN41_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
E9VJD7_ECOLX	-ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK
E9TYV6_ECOLX	-MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-
F4UN92_ECOLX	-ALIGLLAVCATVLCFLLIIFRERLCELNIHRGNTVQVTLAYEAR
F8XK11_ECOLX	-MLIALIVICLTVIVTALVTRKDLCEVRIRIGQTEVAVFTAYEPE-E-

G1ZVT9_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 E9Y7R9_ECOLX -FLMLLIVICVTILCFVWMVRDLSLGLRLQGGNTVLVATLAYEVK--R-----
 H4LXZ6_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 D6HWC9_ECOLX -MLIALIVICLTVIMTALVTRKDLCEVRI RTGQTEVAVFTAYES--E-----
 E2KHD1_ECO57 -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 F9S7G0_9VIBR -ALLGLIVICLTVLCTFTWMTRGTLCELHFKDGNVVISATLAYES--R-----
 G5W2A4_ECOLX -MLVAVIVLCLTVIVTALVTRKDLCEVRLRTGQTEVAVFTAYEPE--E-----
 E8HUC2_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 HOKD_ECO57 -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 B2U569_SHIB3 -GLLSLIVICFTLLFFFTWMVRDLSLCELHIKQGSYELAAFLACNLK-----
 H9YDF6_ECOKO -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLKELESSAGSYSRLSYGVAHSH-
 E1IYD1_ECOLX -LVVCLLIICITILFTLLTRQTLVELRFRDGDKEVAALMACTS--R-----
 G2FAK9_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 E9XTT2_ECOLX -LVWCVLIVCLTLLIFTYLRKSLCEIRYRDGHREVA AFMAYESG--K-----
 E8I198_ECOLX -ALVAVIVLCLTVPGFTLLVGDSLCEFTVKERNIEFRAVLAYEPK-----
 G5Y5U9_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 B3HJT0_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 E9U427_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 D8E8Z0_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 G2S0L6_ENTAL -VSGIVFIICLTVIFTFINRGRCLCELTIKSEHQEVA AKLA CLA--G-----
 H5JJ49_ECOLX -L--TAITFCVTVILIIWMLHGSLCEIRMSFWGA EF AAFLOCK---Q-----
 E1PB25_ECOAB -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 H5GQ22_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 E7HA11_ECOLX -I--IVGMLCLTMLLT VVWLHASPCEFRVSFMWSEIAAFLQCK---P-----
 G8XCJ0_KLEPN -LLGCVLIVCLTLLIFTYLRKSLCEIRYRDTNREVA AF LAYESA--K-----
 H4JR53_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 G5XXC8_ECOLX -L--TAITFCVTAILIIWMLHGSLCEIRMSFWGA EF AAFLOCK---Q-----
 Q3Z5Z9_SHISS -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 E0I209_ECOLW -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 G5KK22_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 H6MBN5_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 D5CWF7_ECOKI -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 B2TTD6_SHIB3 -ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 D3H5D3_ECO44 -LIWCVLIVCCTLLIFTFLTRNRLCEVRLKDGYREV TATMAYESGGK-----
 D6J6R3_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 F5VK79_ENTSA -LLACLFMVCVTILIFALMNQGTLCHE TIRSGSQEVA AKLACTG--K-----
 B6ZP83_ECO57 -ALVAVIVLCLTVPGFTLLVGDSLCEFTVKERNIEFRAVLAYEPK-----
 B3I927_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 H5FWT6_ECOLX -L--TAITFCVTAILIIWMLHGSLCEIRMSFWGA EF AAFLOCK---Q-----
 H5BXU3_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 G5W9P6_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 D6IMK6_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 H4Q809_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 E5B936_ERWAM -LIWCVLIVCCTLLIFTYLRKSLCEIRYKDG YREVA AFMAYESG--K-----
 D8C2A4_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACKLKE-----
 F9HSF5_ECOLX -----MTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 E8YBF8_ECOKO -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFDYESR--E-----
 H6MHP8_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 F4VXG3_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 E1IRH6_ECOLX -ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKVVLAYEPK-----
 H5NFV4_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 H7CRD5_ECO57 -LVWCVLIVCLTLLIFTYLRKSLCEIRYRDGYREVA AFMAYESG--K-----
 F1XMB4_ECO57 -I--IVGMLCLTMLLT VVWLHASPCEFRVSFMWSEIAAFLQCK---P-----
 E8I9N6_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 C8TWH1_ECO26 -ALIGLLAVCATVLCFSLIFRERLCELNIYRGNTVQVTLAYEAR-----
 E1IQK3_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 B2NP37_ECO57 -I--IVGMLCLTMLLT VVWLHASPCEFRVSFMWSEIAAFLQCK---P-----
 D6GL38_9ENTR -LLFGLVICFTILLTWMVRDLSLCELQLRQGNIELVAFLACDIKQ-----
 G5TUD2_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
 E7TAB1_SHIFL -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 E9Y8K4_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 H1F377_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 F8XED9_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 F7MUV5_ECOLX -L--TAITFCVTVILIIWMLHGSLCEIRMSFWGA EF AAFLOCK---Q-----
 H4NJR3_ECOLX -I--IVGMLCLTMLLT VVWLHASPCEFRVSFMWSEIAAFLQCK---P-----
 H4KT12_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 H1FAP9_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE--E-----
 F9CEP4_ECOLX -ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKVVLAYEPK-----
 B2U6D2_ECOLX -LIWCVLIVCCTLLIFTLLTRNRLCEVRLKDGYREV TATMAYESGGK-----
 B6ZRV0_ECO57 -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
 B3X849_ECOLX -RLLSLIVICFTLLFFFTWMIRDLSLCELHIKQGSYELAAFLACKLKE-----
 E1IOA5_ECOLX -LVVCLLIICITILFTLLTRQTLVELRFRDGDKEVAALMACTS--R-----
 H5A0H9_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 G5X3P4_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
 H5KI64_ECOLX -ALVAIVLCTVGLFTLMVGDSLCELSIRERGM EF KAVLAYESK-----
 G5WI34_ECOLX -FLMLLIVCVTILCFVWMVRDLSLGLRLQGGNTVLVATLAYEVK--R-----
 F3Q9V6_9ENTR ---MAIVLCTVGLFTLLVHSSLCELSIKERNIEFKAVLAYESK-----

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D8B2D1_ECOLX -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE-E-----
E9VCC9_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
H5AV32_ECOLX -L---TTITFCVTAILIIWMLHGSLCEIRMSFWGAEEFAAFLQCK---Q-----
F3V7U1_SHIDY -L---TAITFCVTVILIIWMLHGSLCEIRMSFWGAEEFAAFLQCK---Q-----
E9Y8K6_ECOLX -ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
H4YAG3_ECOLX -----MCATVLCFSLIFRERLCELNIIHRGNTVVQVTLAYEARQCEVFQGTPIYPETADPARA
E1IRH4_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
G5UXX9_ECOLX -RLLSLIVICFTLLFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
C6UR89_ECO5T -MLIALIVICITVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE-E-----
Q0H0B2_ECOLX -ALIGVLAVCATVLCFLLIFRERLCELNIIHRGNTVVQVTLAYEAR-----
C8SY02_KLEPR -LVWCVLIVCLTLLIFTCLTRNRLCEVRLKDG NREVAASLAYESNGK-----
H5H178_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
C8TPL3_ECO26 -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE-E-----
H9YME7_ECOKO -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
G5XGE5_ECOLX -ALVAIIVLCTVLGFTLLVGDSLCELSIRERGM EFKAVLAYESK-----
Q8Z607_SALTI -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFVDYESR-E-----
I0QXL4_9ENTR LFIAGLIVICVTLLSFTWMTRDLSLCEIRFSDGIKEVVALMACETTR-----
G5WKB9_ECOLX -RLLSLIVICFTLLFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
F4UZC8_ECOLX -ALVAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKAVLAYEPK-----
H3M9M9_KLEOX -ALVAIVLCLTVLGFTLLVRSSLCELSIKERSMEFKAVLAYESK-----
B3H9D0_ECOLX -L---TAITFCVTVILIIWMLHGSLCEIRMSFWGAEEFAAFLQCK---Q-----
F1XSU4_ECO57 -ALVAVIVLCLTVPGFTLLVGDSLCEFTVKERNIEFRAVLAYEPK-----
D3RCX9_KLEVT -LLGGLVVICFTILLTWMVRDLSLCELQLRQGNIELVAFLACDIKQ-----
H4FPV2_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
F9CJU5_ECOLX -L---TAIMFCVTVIFXIWMLHGSLCEFRNLN LGAEFAAFLQCK---Q-----
H5JUR0_ECOLX -ALAAVIVLCLTVLGFTLLVGDSLCEFTVKERNIEFKVVLAYEPK-----
H5AS66_ECOLX -I---IVGMLCLTMLLTVVWLHASPCEFRVSF MWSEIAAFLQCK---P-----
C8UQU5_ECO1A -VVLCVLIVCLTLLIFTWLTRNSLCELRLKDG TREVSAMVDYESG-K-----
G5X8B3_ECOLX -L---TAITFCVTAILIIWMLHGSLCEIRMSFWGAEEFAAFLQCK---Q-----
H4MLQ7_ECOLX -ALVAVIVLCLTVPGFTLLVGDSLCEFTVKERNIEFRAVLAYEPK-----
E7JA92_ECOLX -RLLSLIVICFTLLFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
G0GSM6_KLEPN -ALVAIIVLCLTVLGFTLLVHSSLCELSIKERNIEFKAVLAYESK-----
G9RE52_9ENTR -ALVAIIVLCLTVLGFTLLVHSSLCELSIKERNIEFKAVLAYESK-----
H5CWM5_ECOLX -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
G7RV84_KLEPN -LLGCVLIVCLTLLIFTYLTRKSLCEIRYRD TNREVAAFMAYESA-K-----
HOKC_SHIFL -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
B3AGC6_ECO57 -RLLSLIVICFTLLFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----
H8WUZ6_SALTS ---MMLIVICVTILCFVMMVRDLSL CGLRLQQGN TVLVATLAYEVK-R-----
B5R4Z4_SALEP -MLIALIVICLTVIVTALVTRKDLCEVRI RTGQTEVAVFTAYEPE-E-----
E8H236_ECO57 -MIVALIVICITAVVAALVTRKDLCEVHIRTGQTEVAVFTAYES--E-----
G2AM71_ECOLX -RLLSLIVICFTLLFFTWMIRDLSLCELHIKQGSYELAAFLACNLK-----

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HOKC_ECOLI -----
F3VWM0_SHIBO -----
H5R5N6_ECOLX -----K
C6UVK1_ECO5T -----
HOKF_ECO57 -----K
H4V506_ECOLX -----K
E2QGR9_ECOLX -----
D6J7Q5_ECOLX -----K
F4TJV8_ECOLX -----K
G0F2P1_ECOLX -----
G1Z0S1_ECOLX -----K
G1YEQ3_ECOLX -----K
F9CTD1_ECOLX -----
H4IYN1_ECOLX -----
F5NNJ6_SHIFL -----
E1J5E3_ECOLX -----
B7N6Z5_ECOLU -----K
H1FMW9_ECOLX -----K
F9CSC2_ECOLX -----
H8D654_ECOLX -----K
E9TXJ2_ECOLX -----
H5J5L9_ECOLX -----K
H5NSR7_ECOLX -----
E2X956_SHIDY -----K
D8E1P5_ECOLX -----K
H5PSJ3_ECOLX -----E
D2AAD3_SHIF2 -----
H1DN41_ECOLX -----K
E9VJD7_ECOLX -----K
E9TYV6_ECOLX -----
F4UN92_ECOLX -----K
F8XK11_ECOLX -----
G1ZVT9_ECOLX -----K

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E9Y7R9	ECOLX	-----
H4LZX6	ECOLX	-----E
D6HWC9	ECOLX	-----
E2KHD1	ECO57	-----K
F9S7G0	9VIBR	-----
G5W2A4	ECOLX	-----
E8HUC2	ECOLX	-----
HOKD	ECO57	-----
B2U569	SHIB3	-----
H9YDF6	ECOKO	CTQIYFSQK
E1IYD1	ECOLX	-----
G2FAK9	ECOLX	-----
E9XTT2	ECOLX	-----
E8II98	ECOLX	-----K
G5Y5U9	ECOLX	-----
B3HJT0	ECOLX	-----K
E9U427	ECOLX	-----K
D8E8Z0	ECOLX	-----K
G2S0L6	ENTAL	-----
H5JJ49	ECOLX	-----
E1PB25	ECOAB	-----K
H5GVQ2	ECOLX	-----K
E7HA11	ECOLX	-----
G8XCJ0	KLEPN	-----
H4JR53	ECOLX	-----K
G5XXC8	ECOLX	-----
Q3Z5Z9	SHISS	-----
E0IZ09	ECOLW	-----
G5KK22	ECOLX	-----K
H6MBN5	ECOLX	-----
D5CWF7	ECOKI	-----K
B2TTD6	SHIB3	-----K
D3H5D3	ECO44	-----
D6J6E3	ECOLX	-----
F5VK79	ENTSA	-----
B6ZP83	ECO57	-----K
B3I927	ECOLX	-----K
H5FWT6	ECOLX	-----
H5BXU3	ECOLX	-----E
G5W9P6	ECOLX	-----K
D6IMK6	ECOLX	-----
H4Q809	ECOLX	-----E
E5B936	ERWAM	-----
D8C2A4	ECOLX	-----
F9HSF5	ECOLX	-----K
E8YBF8	ECOKO	-----
H6MHP8	ECOLX	-----K
F4VXG3	ECOLX	-----
E1IRH6	ECOLX	-----K
H5NFB4	ECOLX	-----E
H7CRD5	ECO57	-----
F1XMB4	ECO57	-----
E8I9N6	ECOLX	-----
C8TWH1	ECO26	-----K
E1IQK3	ECOLX	-----K
B2NP37	ECO57	-----
D6GL38	9ENTR	-----
G5TUD2	ECOLX	-----K
E7TAB1	SHIFL	-----
E9Y8K4	ECOLX	-----
H1F377	ECOLX	-----
F8XED9	ECOLX	-----E
F7MUV5	ECOLX	-----
H4NJR3	ECOLX	-----
H4KT12	ECOLX	-----
H1FAP9	ECOLX	-----
F9CEP4	ECOLX	-----K
B2U6D2	ECOLX	-----
B6ZRV0	ECO57	-----E
B3X849	ECOLX	-----
E1I0A5	ECOLX	-----
H5A0H9	ECOLX	-----K
G5X3P4	ECOLX	-----
H5KI64	ECOLX	-----K
G5WI34	ECOLX	-----
F3Q9V6	9ENTR	-----K
D8B2D1	ECOLX	-----

E9VCC9_ECOLX	-----
H5AV32_ECOLX	-----
F3V7U1_SHIDY	-----
E9Y8K6_ECOLX	-----K
H4YAG3_ECOLX	STQ-----V
E1IRH4_ECOLX	-----K
G5UXX9_ECOLX	-----E
C6UR89_ECO5T	-----
Q0H0B2_ECOLX	-----K
C8SY02_KLEPR	-----
H5H178_ECOLX	-----
C8TPL3_ECO26	-----
H9YME7_ECOKO	-----K
G5XGE5_ECOLX	-----K
Q8Z607_SALTI	-----
I0QXL4_9ENTR	-----
G5WKB9_ECOLX	-----E
F4UZC8_ECOLX	-----K
H3M9M9_KLEOX	-----K
B3H9D0_ECOLX	-----
F1XSU4_ECO57	-----K
D3RCX9_KLEVT	-----
H4FPV2_ECOLX	-----
F9CJU5_ECOLX	-----
H5JUR0_ECOLX	-----K
H5AS66_ECOLX	-----
C8UQU5_ECO1A	-----
G5X8B3_ECOLX	-----
H4MLQ7_ECOLX	-----K
E7JA92_ECOLX	-----E
G0GSM6_KLEPN	-----K
G9RE52_9ENTR	-----K
H5CWM5_ECOLX	-----
G7RV84_KLEPN	-----
HOKC_SHIFL	-----
B3AGC6_ECO57	-----E
H8WUZ6_SALTS	-----
B5R4Z4_SALEP	-----
E8H236_ECO57	-----
G2AM71_ECOLX	-----E

Supplemental Table S8. ConSurf Results.

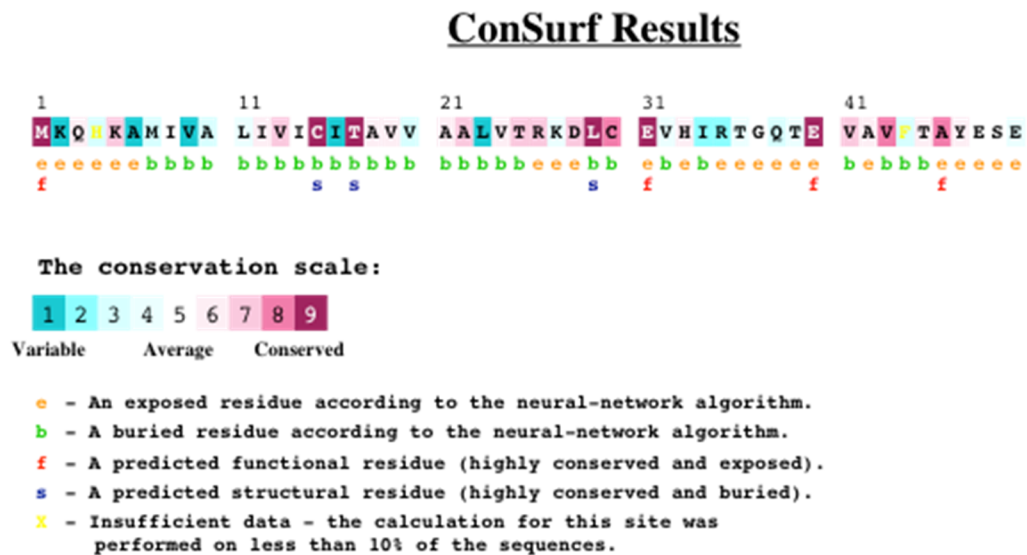


Table S9. Predictions of deleterious mutations in HokC family by PROVEAN.

Position
Variants

Score
Predicted mutation
1
M,A,M
-2.534
Deleterious
2
K,M,N,T,P,S,I,K,L,Q,W
0.264
Neutral
3
Q,Q,R,P,S
0.000
Neutral
4
H,Q,L,N,R,H,G,A
0.518
Neutral
5
K,K,H,R,Q,N,S
0.000
Neutral
6
A,V,T,P,S,C,Y,A,I
-1.188
Neutral
7
M,M,G,R,V,I,F,A,L
0.000
Neutral
8
I,I,V,L,S
0.000
Neutral
9
V,V,M,G,W,L,A,F,I
0.000
Neutral
10
A,T,S,M,G,A,I,C
-1.254
Neutral
11
L,L,T,V,A,I
0.000
Neutral
12
I,G,F,I,V,L
-6.218
Deleterious
13
V,A,M,I,V,T
-3.567
Deleterious
14
I,M,F,I,V,L,S
-2.495
Neutral

15
C,C
0.000
Neutral
16
I,C,F,I,A,M,V,L
-2.476
Neutral
17
T,T
0.000
Neutral
18
A,I,A,M,V,L
2.002
Neutral
19
V,I,L,V,P
0.741
Neutral
20
V,F,I,L,M,G,C,V,T,S
-2.136
Neutral
21
A,F,I,A,T,L,X
3.270
Neutral
22
A,V,T,L,S,A,I
0.901
Neutral
23
L,Y,L,W,F,C
0.127
Neutral
24
V,V,L,I,M
0.000
Neutral

Table S10. Multiple deleterious mutations found in sequences of the HokC family.

<i>Uniprot sequence ID</i>	<i>Intolerable mutations</i>
G2AM71_ECOLX	V19L, A22T
G0F2P1_ECOLX	V19L, A22T
E9XTT2_ECOLX	V13I, V19L, A22T
G5KK22_ECOLX	V19L, A22T
B2TTD6_SHIB3	V19L, A22T
E2X956_SHIDY	V19L, A22T

H4IYN1_ECOLX	V19L, A22T
F9CEP4_ECOLX	V19L, A22T
H5A0H9_ECOLX	V19L, A22T
F9HSF5_ECOLX	V19L, A22T
H5AS66_ECOLX	A6T, V19L, A21T
E7JA92_ECOLX	V19L, A22T
E1IQK3_ECOLX	V19L, A22T
E9Y8K6_ECOLX	V19L, A22T
G8XCJ0_KLEPN	A6T, V13I, V19L, A22T
H5JUR0_ECOLX	V19L, A22T
H1FMW9_ECOLX	V19L, A22T
H5BXU3_ECOLX	V19L, A22T
G7RV84_KLEPN	A6T, V13I, V19L, A22T
C8TWH1_ECO26	V19L, A22S
G5W9P6_ECOLX	V19L, A22T
G2S0L6_ENTAL	A6T, V13I, A22T
H5R5N6_ECOLX	V19L, A22T
C8UQU5_ECO1A	V13I, V19L, A22T
E1PB25_ECOAB	V19L, A22T
E1I0A5_ECOLX	V13I, V19L, A22T
B2U6D2_ECOLX	V13I, V19L, A22T
G1Z0S1_ECOLX	V19L, A22T
H7CRD5_ECO57	V13I, V19L, A22T
D8E8Z0_ECOLX	V19L, A22T
H4JR53_ECOLX	V19L, A22T
B3X849_ECOLX	V19L, A22T
E2KHD1_ECO57	V19L, A22T
G1YEQ3_ECOLX	V19L, A22T
F8XED9_ECOLX	V19L, A22T
F4UZC8_ECOLX	V19L, A22T

C8SY02_KLEPR	V13I, V19L, A22T
D2AAD3_SHIF2	V19L, A22T
H9YME7_ECOKO	V19L, A22T
G5UXX9_ECOLX	V19L, A22T
E7HA11_ECOLX	A6T, V19L, A21T
E1IRH6_ECOLX	V19L, A22T
B3HJT0_ECOLX	V19L, A22T
B3AGC6_ECO57	V19L, A22T
D6J7Q5_ECOLX	V19L, A22T
E1IRH4_ECOLX	V19L, A22T
D8C2A4_ECOLX	V19L, A22T
E9VJD7_ECOLX	V19L, A22T
H4V506_ECOLX	V19L, A22T
D3RCX9_KLEVT	V19L, A22T
G5TUD2_ECOLX	V19L, A22T
B7N6Z5_ECOLU	V19L, A22T
H6MHP8_ECOLX	V19L, A22T
H4LZX6_ECOLX	V19L, A22T
G5XGE5_ECOLX	V19L, A22T
F3Q9V6_9ENTR	V19L, A22T
D3H5D3_ECO44	V13I, V19L, A22T
D6GL38_9ENTR	V19L, A22T
B3I927_ECOLX	V19L, A22T
H5PSJ3_ECOLX	V19L, A22T
E1IYD1_ECOLX	V13I, V19L, A22T
B6ZRV0_ECO57	V19L, A22T
I0QXL4_9ENTR	V19L, A22T
G9RE52_9ENTR	V19L, A22T
H3M9M9_KLEOX	V19L, A22T
F5NNJ6_SHIFL	V19L, A22T

E2QGR9_ECOLX	V19L, A22T
B2U569_SHIB3	V19L, A22T
H5J5L9_ECOLX	V19L, A22T
E5B936_ERWAM	V13I, V19L, A22T
H4YAG3_ECOLX	V19L, A22S
B2NP37_ECO57	A6T, V19L, A21T
G5WI34_ECOLX	K2M, A6T, V19L
G5WKB9_ECOLX	V19L, A22T
F4TJV8_ECOLX	V19L, A22T
G1ZVT9_ECOLX	V19L, A22T
H5NFV4_ECOLX	V19L, A22T
E9Y7R9_ECOLX	A6T, V19L
H9YDF6_ECOKO	V19L, A22T
H4NJR3_ECOLX	A6T, V19L, A21T
H5KI64_ECOLX	V19L, A22T
E9U427_ECOLX	V19L, A22T
D5CWF7_ECOKI	V19L, A22T
F9S7G0_9VIBR	A6T, V19L, A22T
H4Q809_ECOLX	V19L, A22T
H5GVQ2_ECOLX	V19L, A22T
G0GSM6_KLEPN	V19L, A22T
H8D654_ECOLX	V19L, A22T
D8E1P5_ECOLX	V19L, A22T
H1DN41_ECOLX	V19L, A22T
F1XMB4_ECO57	A6T, V19L, A21T

Supplementary Table S11A. Globular proteins used to compute the correlated mutation index.

PDB ID	Chain ID
---------------	-----------------

1a3a	A
1a6m	A
1a70	A
1aap	A
1aba	A
1ag6	A
1aoe	A
1atl	A
1atz	A
1avs	A
1bdo	A
1beb	A
1beh	A
1bkr	A
1brf	A
1bsg	A
1c44	A
1c52	A
1c9o	A
1cc8	A
1chd	A
1cjw	A
1cke	A
1ctf	A
1cxy	A
1czn	A
1d0q	A
1d1q	A
1d4o	A
1dbx	A

1dix	A
1dlw	A
1dmg	A
1dqg	A
1dsx	A
1eaz	A
1ej0	A
1ej8	A
1ek0	A
1f6b	A
1fcy	A
1fk5	A
1fl0	A
1fna	A
1fmt	A
1fvg	A
1fvk	A
1fx2	A
1g2r	A
1g9o	A
1gbs	A
1gmi	A
1gmh	A
1guu	A
1gz2	A
1gzc	A
1h0p	A
1h2e	A
1h4x	A
1h98	A

1hdo	A
1hfc	A
1hh8	A
1htw	A
1hxn	A
1i1j	A
1i1n	A
1i4j	A
1i58	A
1i5g	A
1i71	A
1ihz	A
1iib	A
1im5	A
1iwd	A
1j3a	A
1jbe	A
1jbk	A
1jfu	A
1jfx	A
1jkx	A
1jl1	A
1jo0	A
1jo8	A
1jos	A
1jvw	A
1jwq	A
1jyh	A
1k6k	A
1k7c	A

1k7j	A
1kid	A
1kq6	A
1kqr	A
1ktg	A
1ku3	A
1kw4	A
1lm4	A
1lo7	A
1lpy	A
1m4j	A
1m8a	A
1mk0	A
1mug	A
1nb9	A
1ne2	A
1nps	A
1nrv	A
1ny1	A
1o1z	A
1p90	A
1pch	A
1pko	A
1qf9	A
1qjp	A
1ql0	A
1r26	A
1roa	A
1rw1	A
1rw7	A

1ryb	A
1smx	A
1svy	A
1t8k	A
1tif	A
1tqg	A
1tqh	A
1tzv	A
1vfy	A
1vhu	A
1vjk	A
1vmb	A
1vp6	A
1w0h	A
1whi	A
1wjx	A
1wkc	A
1xdz	A
1xff	A
1xkr	A
2arc	A
2cua	A
2hs1	A
2mhr	A
2phy	A
2tps	A
2vxn	A
3bor	A
3dqq	A
5ptp	A

Supplementary Table S11B. Transmembrane proteins used to compute the correlated mutation index.

<i>PDB ID</i>	<i>Chain ID</i>
2fma	A
1lv7	A
1ihr	A
1l2p	A
1nkz	R
1rzh	H
2wjn	H
2cua	A
3s8f	C
3cx5	O
3cx5	P
3cx5	S
3cx5	T
1kqf	H
1nkz	S
1v54	Q
1v54	T
1v54	V
1v54	W
1v54	X
1v54	Y
1v54	Z
1s3e	A
1e2w	A
1a64	A

1fv1	A
1icf	I
1xiw	A
4tsv	A
1mf7	A
1xh3	A
2hft	—
1ijq	A
1aly	—
1v7p	C
1eue	A
1i4f	A
1b0x	A
1f2l	A
1b4f	B
1bqu	A
2ddf	A
1n7s	B
1bte	A
1tjx	A
1juf	A
1ql3	A
1cdy	—
1cfb	—
1eer	C
1mjn	A
1j8e	A
1hcz	—
1dg6	A
1d5m	B

1iak	A
1iak	B
1dl2	A
1r1h	A
1klu	B
1dp4	A
1dqg	A
1dqt	A
1e1h	B
1gp0	A
1e87	A
1eax	A
1edh	A
1epf	A
1rew	D
1g1t	A
1ext	A
1f46	A
1yro	D
2b8l	A
1flt	X
1x9d	A
1fne	A
1lk2	A
1g1s	A
1r2d	A
1gv9	A
1p9a	G
1o7q	A
2cl5	A

1he7	A
1jgd	A
1qwn	A
1vca	A
1iko	P
1s55	A
1jd0	A
1jdp	A
1jfu	A
1jln	A
1yuk	B
2bnu	A
1m9z	A
1lqv	A
1lar	A
1lcy	A
1lr0	A
1lzj	A
1m6o	A
1n3y	A
1ncg	—
1neu	—
1nko	A
1nkr	—
1npu	A
1nrj	B
1pfq	A
1z8g	A
1uze	A
1qfo	A

1olz	A
1wt4	B
1yfn	E
1ot8	A
1p15	A
2f8y	B
1pt6	A
1r55	A
1rfs	—
1rhf	A
1rm8	A
1shu	X
1t0p	B
1uv7	A
1v84	A
1w15	A
1wwc	A
1xed	A
1xiw	F
1xu1	R
1ydp	A
2o3s	A
1z40	A
1z5y	E
1z9l	A
2a6z	A
2fy7	A
2ajc	A
2b7k	A
2hc1	A

2c6c	A
2c7s	A
2fcb	A
2gu3	A
2tnf	A
2apc	A
2nvg	A
2j8c	H
2bba	A
2ciu	A
2d0j	A
2gak	A
2gsf	A
2h1b	A
2h26	A
2h4v	A
2hey	R
2hew	F
2hjl	A
2hlr	A
2i1m	A
2i6v	A
2ims	A
2jcq	A
2isg	A
3arc	e
3arc	f
3arc	h
3arc	i
3arc	j

3arc	k
3arc	l
3arc	m
3arc	t
3arc	y
3arc	x
2z62	A
3llk	C
4n7i	A
2qqi	A
2r2o	B
1fv1	E
2gh0	B
3sov	A
2omz	B
2haz	A
4kmy	A
4fyt	A
4km6	A
1sm3	P
1itu	B
2o6l	B
3s98	A
1ly2	A
4h2g	A
3jxf	B
3i84	B
3v6o	B
2pet	A
1ypq	B

2fh7	A
3teq	D
4cnm	A
2h62	D
1eg4	P
4gwm	B
3pv7	A
3kgr	C
4l4v	C
3f6k	A
4h5s	B
3n2n	F
3wn4	A
2jjw	A
4hdq	C
3fed	A
3h6n	A
3pxh	A
2y8t	D
1ynl	H
3nfk	D
2bnq	E
3pve	B
2d3v	A
4eby	A
2qsq	B
1h03	Q
4fke	A
3cl5	A
3qw9	B

2dur	B
3qup	A
3nk4	D
2wv3	A
2yz1	B
4fww	A
3t6q	B
3bix	D
3o71	B
2xot	B
2ox9	D
2ic2	B
4lxj	A
2a6v	B
2qqj	A
2v9t	A
2vsm	B
3r0n	A
2ffu	A
3n1f	D
1po5	A
3g5b	A
2j0a	A
2ooq	B
3noi	B
4oac	A
3ner	B
3l4y	A
4j2c	C
1hq8	A

4dnd	A
1oll	A
3ff9	B
1gl2	C
3q3j	A
4iqh	C
3pvh	A
4h5s	A
1cyo	A
2q86	C
1oga	E
2q86	D
2aju	H
3vcl	A
1uvq	A
1qjb	S
1lcj	B
2hi4	A
3rl1	A
3vj6	A
1j02	A
1n45	B
4a4y	A
3owv	B
3lgi	C
3azc	A
2rl8	B
3khq	A
2wy3	D
2yd1	A

4nn5	B
2bvp	A
3rrc	B
2h64	C
3m9z	A
3b5n	I
1xr9	A
4jqv	A
3ln4	A
4jqu	B
3fp2	A
3zf8	A
1tvb	F
4g1i	B
2ibj	A
4hq1	A
4nzt	M
3q2u	A
2wo1	B
2zvy	B
2jik	B
3cyp	E
4e5x	H
1eaj	B
3ig3	A
4bhu	J
1ci3	M
4dgj	D
3gmg	B
4esq	A

3c5j	B
1rwi	B
1zxk	B
3f61	A
3ca7	A
4alz	A
3onj	A
1obx	B
2oo4	B
2wnf	A
2ptt	B
2guz	O
4of8	D
3q4u	D
1wt6	D
3jxg	D
2z3q	D
4bkj	B
1jr8	B
3o3u	N
1d4t	B
3gyl	B
3ey6	A
2wy3	C
2rei	A
3q0h	B
4ggj	A
2oya	B
2bpd	B
3vpp	B

3so5	B
3mw4	C
3lz6	D
2q8o	B
4nmu	D
2avd	B
2frg	P
4esk	D
4de9	A
4gos	A
4oag	B
2f4w	B
2gw5	A
2c1i	A
1ugn	A
4mz2	A
2e7v	A
4m7h	B
3dlq	R
2b69	A
3p2t	A
3wbp	B
1s1d	B
2pof	B
3ff7	D
3mxo	B
3mvs	A
4apx	B
3n1m	C
2hl7	A

3vbc	A
3bod	A
4e74	A
4m92	B
1u9k	B
2xr6	A
1smo	B
2yhf	I
4ezf	B
4ak8	D
2c6u	A
4lu3	A
3wh2	A
2q87	C
2oq5	A
2yfx	A
2r32	A
3mdm	A
4gel	B
4lr2	A
3bp6	B
3rs1	B
1t8t	B
2icc	A
2wh6	A
2xz4	B
2o9g	D
3bs6	B
2fwh	A
1d06	A

2ff7	A
1b12	A
2cbz	A
1d4o	A
3llo	A
1a3a	A
2zpm	A
1vls	—
1rzh	L
2a65	A
1dsx	D
1rzh	M
1m0k	C
2ih3	F
2wjn	L
2wjn	M
2jaf	C
2bs2	F
3s8f	A
3cx5	N
3qap	A
1h2s	D
4dx5	C
3arc	a
3arc	b
3arc	c
3arc	d
1kqf	I
3ldc	D
2gsm	A

2gsm	B
4eiy	A
3bya	B
1v54	N
1v54	O
1v54	P
1ors	C
4n6h	A
1q16	C
2b6o	A
1u7g	C
1xio	A
2h88	C
2h88	D
2f2b	D
2b2h	C
3k04	E
2a0b	—
1gpr	—
1djl	A
1dqa	A
1mqi	A
1fx2	A
1fx4	A
1g4y	B
1id0	A
1ijy	A
1xzz	A
1nxc	A
1p0z	A

1pb7	A
1py9	A
1q3e	A
1s50	A
1t0j	C
2f34	A
1uc7	A
1xaw	A
1x13	A
1xkz	A
1ysr	A
2hje	A
2a5s	A
2xov	A
4a82	B
2j8c	L
2j8c	M
2bcx	B
2bou	A
2ixe	A
3i8s	C
3l9w	B
3bp3	B
3fwz	B
4n7w	A
3qbg	D
3arc	Z
3pcv	C
3b9w	C
3m73	C

3d9s	D
3ddl	A
4al0	C
3gd8	D
2qts	C
3zpj	D
4f4s	T
2xqu	P
3v5u	A
3tds	D
3ouf	E
3rlb	A
4ikv	A
3gkj	A
4ms4	B
3a1f	A
3rn8	C
2vns	B
3w19	C
2y8t	E
3lsw	A
3s9e	B
1mix	A
3om0	A
3lwt	X
4m5b	A
4o6y	B
4etv	B
3a9f	B
2pux	C

2voh	B
3dt5	A
1z0w	A
2xme	L
3skx	A
2r48	A
3kkb	B
3ehg	A
3tyq	B
1aol	A
2x49	A
3iqt	A
4o6m	B
4pgr	A
3gwi	A
4hhx	A
3ezh	B
3pp4	P
4dey	B
1mvu	P
4bgc	A
4e29	B
3g3t	A
3hfe	C
2pfi	B
2cjz	A
3jrr	B
2jli	A
2r4q	A
2nl9	A

3k6y	A
3rkg	A
1txo	B
4dex	B
3pty	A
2xdg	B
3zlc	B
3kyz	A
3qxm	B
3hrn	A
3nfl	H
2vay	B
4erv	A
4djc	B
3ftj	A
3swy	C
4loj	B
3sl2	A
1xhk	B
3vn0	D
2wji	B
4gag	P
2v3u	A
1s6c	B
2w5q	A
4gt8	A
3eu9	C
4emt	B
3cqb	B
4n5q	B

1ia9	B
1wv3	A
2rca	B
2rfa	A
4ehq	G
3t4l	B
4aqr	D
2rc8	B
2xtp	A
3dxs	X
4pas	A
2f37	B
2etb	A
1qjp	A
3m4d	G
3prn	—
4gcs	A
2fgq	B
2vdf	A
1kmo	A
3gp6	A
2guf	A
1qj8	A
2por	—
3pgu	A
1yc9	C
2erv	B
1xkw	A
2gr8	D
2o4v	C

2j1n	C
2y2x	A
3aeh	A
2zfg	C
3fid	A
4afk	A
2wjr	A
2x55	A
4fqe	A
3szv	A
4e1s	A
3qra	A
4frx	A
1f00	I

Supplementary Table S12A. Globular proteins used to compute maximal cliques, size-order and spherical coordinates.

16PK A, 1A0M A, 1A0M B, 1A12 A, 1A12 B, 1A12 C, 1A1X A, 1A27 A, 1A2P A, 1A2P B, 1A2P C, 1A3A A, 1A3A B, 1A3A C, 1A3A D, 1A3I A, 1A3I B, 1A3I C, 1A3J A, 1A3J B, 1A3J C, 1A4I A, 1A4I B, 1A62 A, 1A6M A, 1A6Q A, 1A7S A, 1A7T A, 1A7T B, 1A7Y A, 1A7Y B, 1A7Y C, 1A7Z A, 1A7Z B, 1A8D A, 1A8L A, 1A8Q A, 1A92 A, 1A92 B, 1A92 C, 1A92 D, 1A9X A, 1A9X B, 1A9X C, 1A9X D, 1A9X E, 1A9X F, 1A9X G, 1A9X H, 1AA5 A, 1AA5 B, 1AAP A, 1AAP B, 1ABA A, 1ACF A, 1AE9 A, 1AE9 B, 1AF7 A, 1AG9 A, 1AG9 B, 1AGJ A, 1AGJ B, 1AGQ A, 1AGQ B, 1AGQ C, 1AGQ D, 1AH7 A, 1AHO A, 1AIE A, 1AJ2 A, 1AJ8 A, 1AJ8 B, 1AJJ A, 1AJK A, 1AJK B, 1AK0 A, 1AKG A, 1AKO A, 1AL3 A, 1AL4 A, 1AL4 B, 1ALQ A, 1ALU A, 1ALX A, 1ALX B, 1ALY A, 1ALZ A, 1ALZ B, 1AMT A, 1AMT B, 1AMT C, 1AMU A, 1AMU B, 1AMX A, 1AOC A, 1AOC B, 1AOE A, 1AOE B, 1AOH A, 1AOH B, 1AOL A, 1AOZ A, 1AOZ B, 1APY A, 1APY B, 1APY C, 1APY D, 1AQZ A, 1AQZ B, 1AT0 A, 1ATG A, 1ATZ A, 1ATZ B, 1AUO A, 1AUO B, 1AV2 A, 1AV2 B, 1AV2 C, 1AV2 D, 1AVY A, 1AVY B, 1AVY C, 1AYE A, 1AYO A, 1AYO B, 1AZO A, 1B0B A, 1B0N A, 1B0N B, 1B0U A, 1B0X A, 1B12 A, 1B12 B, 1B12 C, 1B12 D, 1B1C A, 1B25 A, 1B25 B, 1B25 C, 1B25 D, 1B2P A, 1B2P B, 1B4F A, 1B4F B, 1B4F C, 1B4F D, 1B4F E, 1B4F F, 1B4F G, 1B4F H, 1B5E A, 1B5E B, 1B5F A, 1B5F B, 1B5F C, 1B5F D, 1B5P A, 1B5P B, 1B5Q A, 1B5Q B, 1B5Q C, 1B63 A, 1B65 A, 1B65 B, 1B65 C, 1B65 D, 1B65 E, 1B65 F, 1B67 A, 1B67 B, 1B6A A, 1B6G A, 1B8A A, 1B8A B, 1B93 A, 1B93 B, 1B93 C, 1B9H A, 1B9M A, 1B9M B, 1B9O A, 1B9W A, 1BAM A, 1BAZ A, 1BAZ B, 1BAZ C, 1BAZ D, 1BD3 A, 1BD3 B, 1BD3 C, 1BD3 D, 1BD8 A, 1BDO A, 1BDW A, 1BDW B, 1BEA A, 1BF2 A, 1BF6 A, 1BF6 B, 1BG6

A,1BGC A,1BGF A,1BGP A,1BGV A,1BHD A,1BHD B,1BHE A,1BI5 A,1BIF A,1BJ7 A,1BKB A,1BKP A,1BKP B,1BKR A,1BM8 A,1BM9 A,1BM9 B,1BOL A,1BQB A,1BQC A,1BQU A,1BQU B,1BRT A,1BS0 A,1BSL A,1BSL B,1BTE A,1BTE B,1BTK A,1BTK B,1BTN A,1BU8 A,1BUO A,1BUU A,1BX4 A,1BX7 A,1BXY A,1BXY B,1BY2 A,1BYF A,1BYF B,1BYI A,1BYR A,1BYZ A,1BYZ B,1BYZ C,1BYZ D,1BZ4 A,1C0P A,1C0Q A,1C0Q B,1C0R A,1C0R B,1C1K A,1C3C A,1C3C B,1C3M A,1C3P A,1C44 A,1C4D A,1C4D B,1C4D C,1C4D D,1C4O A,1C4Q A,1C4Q B,1C4Q C,1C4Q D,1C4Q E,1C52 A,1C53 A,1C5E A,1C5E B,1C5E C,1C75 A,1C7K A,1C7N A,1C7N B,1C7N C,1C7N D,1C7N E,1C7N F,1C7N G,1C7N H,1C8U A,1C8U B,1C9O A,1C9O B,1CB0 A,1CB8 A,1CC8 A,1CCW A,1CCW B,1CCW C,1CCW D,1CCZ A,1CDC A,1CDC B,1CEO A,1CEW I,1CFB A,1CG5 A,1CG5 B,1CHD A,1CHM A,1CHM B,1CI4 A,1CI4 B,1CI9 A,1CI9 B,1CJC A,1CJW A,1CKA A,1CKA B,1CKE A,1CMC A,1CMC B,1CNV A,1COJ A,1COZ A,1COZ B,1CPN A,1CPQ A,1CQ3 A,1CQ3 B,1CQ4 A,1CQ4 B,1CQM A,1CQM B,1CQX A,1CQX B,1CQY A,1CRU A,1CRU B,1CS1 A,1CS1 B,1CS1 C,1CS1 D,1CS6 A,1CS8 A,1CSB A,1CSB B,1CSB D,1CSB E,1CSH A,1CT5 A,1CT9 A,1CT9 B,1CT9 C,1CT9 D,1CTF A,1CUK A,1CUN A,1CUN B,1CUN C,1CV8 A,1CVR A,1CXC A,1CXQ A,1CXY A,1CY5 A,1CY9 A,1CY9 B,1CYD A,1CYD B,1CYD C,1CYD D,1CZA N,1CZF A,1CZF B,1CZQ A,1CZQ D,1CZT A,1CZY A,1CZY B,1CZY C,1CZY D,1CZY E,1D0Q A,1D0Q B,1D1Q A,1D1Q B,1D2N A,1D2O A,1D2O B,1D2S A,1D2T A,1D2Z A,1D2Z B,1D2Z C,1D2Z D,1D3B A,1D3B B,1D3B C,1D3B D,1D3B E,1D3B F,1D3B G,1D3B H,1D3B I,1D3B J,1D3B K,1D3B L,1D3Y A,1D3Y B,1D4A A,1D4A B,1D4A C,1D4A D,1D4O A,1D4T A,1D4T B,1D5T A,1D8H A,1D8H B,1D8H C,1D8W A,1D8W B,1D8W C,1D8W D,1D9C A,1D9C B,1DBF A,1DBF B,1DBF C,1DBW A,1DBW B,1DCI A,1DCI B,1DCI C,1DCS A,1DD9 A,1DDJ A,1DDJ B,1DDJ C,1DDJ D,1DDW A,1DEK A,1DEK B,1DEU A,1DEU B,1DF4 A,1DFA A,1DG6 A,1DGF A,1DGF B,1DGF C,1DGF D,1DGW A,1DGW X,1DGW Y,1DHN A,1DI6 A,1DJ0 A,1DJ0 B,1DJ8 A,1DJ8 B,1DJ8 C,1DJ8 D,1DJ8 E,1DJ8 F,1DJL A,1DJL B,1DK8 A,1DKI A,1DKI B,1DKI C,1DKI D,1DL2 A,1DL5 A,1DL5 B,1DLW A,1DLY A,1DM9 A,1DM9 B,1DMG A,1DMH A,1DMH B,1DNL A,1DNU A,1DNU B,1DNU C,1DNU D,1DOI A,1DOS A,1DOS B,1DOW A,1DOW B,1DP4 A,1DP4 C,1DPG A,1DPG B,1DPJ A,1DPJ B,1DQG A,1DQI A,1DQI B,1DQI C,1DQI D,1DQN A,1DQN B,1DQS A,1DQS B,1DS1 A,1DSL A,1DTJ A,1DTJ B,1DTJ C,1DTJ D,1DUN A,1DUS A,1DVO A,1DW0 A,1DW0 B,1DW0 C,1DWK A,1DWK B,1DWK C,1DWK D,1DWK E,1DWK F,1DWK G,1DWK H,1DWK I,1DWK J,1DXE A,1DXE B,1DXG A,1DXG B,1DXY A,1DY5 A,1DY5 B,1DYK A,1DYP A,1DYQ A,1DYS A,1DYS B,1DZ3 A,1DZF A,1DZK A,1DZK B,1E0B A,1E0B B,1E0C A,1E0T A,1E0T B,1E0T C,1E0T D,1E19 A,1E19 B,1E1H A,1E1H B,1E1H C,1E1H D,1E25 A,1E29 A,1E2K A,1E2K B,1E2W A,1E2W B,1E4C P,1E4M M,1E58 A,1E5K A,1E5P A,1E5P B,1E5P C,1E5P D,1E6B A,1E6C A,1E6C B,1E6I A,1E6I P,1E6U A,1E7L A,1E7L B,1E7W A,1E7W B,1E8C A,1E8C B,1E8Y A,1E9G A,1E9G B,1E9W A,1EA5 A,1EAJ A,1EAJ B,1EAQ A,1EAQ B,1EAR A,1EAZ A,1EB6 A,1ECA A,1ECF A,1ECF B,1ECS A,1ECS B,1EDG A,1EDM B,1EDM C,1EDT A,1EE8 A,1EE8 B,1EER A,1EER B,1EER C,1EEX A,1EEX B,1EEX E,1EEX G,1EEX L,1EEX M,1EF8 A,1EF8 B,1EF8 C,1EFD N,1EG2 A,1EG3 A,1EG5 A,1EG5 B,1EGP A,1EGP B,1EH6 A,1EI5 A,1EJ0 A,1EJ2 A,1EJ8 A,1EJB A,1EJB B,1EJB C,1EJB D,1EJB E,1EJD A,1EJD B,1EJG A,1EK6 A,1EK6 B,1EKE A,1EKE B,1EKJ A,1EKJ B,1EKJ C,1EKJ D,1EKJ E,1EKJ F,1EKJ G,1EKJ H,1EKQ

A,1EKQ B,1EL6 A,1EL6 B,1EL6 C,1ELJ A,1ELK A,1ELK B,1ELU A,1ELU
 B,1ELV A,1ELW A,1ELW B,1ELW C,1ELW D,1EMU A,1EMU B,1EN2 A,1ENF
 A,1EOK A,1EP0 A,1EPW A,1EQ2 A,1EQ2 B,1EQ2 C,1EQ2 D,1EQ2 E,1EQ2
 F,1EQ2 G,1EQ2 H,1EQ2 I,1EQ2 J,1EQ9 A,1EQ9 B,1ES5 A,1ES9 A,1ESW
 A,1ET1 A,1ET1 B,1ET9 A,1ETL A,1ETM A,1ETN A,1EU1 A,1EU3 A,1EU3
 B,1EU8 A,1EUH A,1EUH B,1EUH C,1EUH D,1EUW A,1EVL A,1EVL B,1EVL
 C,1EVL D,1EVX A,1EVX B,1EVY A,1EW0 A,1EW4 A,1EWF A,1EX2 A,1EX2
 B,1EX7 A,1EXR A,1EXT A,1EXT B,1EYE A,1EYH A,1EYQ A,1EYQ B,1EYV
 A,1EYV B,1EZ3 A,1EZ3 B,1EZ3 C,1EZG A,1EZG B,1EZI A,1EZI B,1EZJ
 A,1EZW A,1F00 I,1F08 A,1F08 B,1F0I A,1F0K A,1F0K B,1F0L A,1F0L B,1F0X
 A,1F0X B,1F0Y A,1F0Y B,1F1E A,1F1M A,1F1M B,1F1M C,1F1M D,1F1U
 A,1F1U B,1F20 A,1F2L A,1F2L B,1F2L C,1F2L D,1F2T A,1F2T B,1F32 A,1F39
 A,1F39 B,1F3U A,1F3U B,1F3U C,1F3U D,1F3U E,1F3U F,1F3U G,1F3U
 H,1F3Z A,1F46 A,1F46 B,1F4P A,1F5M A,1F5M B,1F5N A,1F5V A,1F5V
 B,1F60 A,1F60 B,1F6B A,1F6B B,1F74 A,1F74 C,1F7D A,1F7D B,1F7L
 A,1F7S A,1F86 A,1F86 B,1F94 A,1F9P A,1F9V A,1F9Z A,1F9Z B,1FAO
 A,1FBT A,1FBT B,1FC3 A,1FC3 B,1FC3 C,1FC4 A,1FC4 B,1FC6 A,1FCQ
 A,1FCY A,1FD3 A,1FD3 B,1FD3 C,1FD3 D,1FEC A,1FEC B,1FG7 A,1FGY
 A,1FHG A,1FIP A,1FIP B,1FIP C,1FIP D,1FIT A,1FJ2 A,1FJ2 B,1FJH A,1FJH
 B,1FJJ A,1FK5 A,1FKM A,1FL0 A,1FL2 A,1FM0 D,1FM0 E,1FMB A,1FMC
 A,1FMC B,1FMJ A,1FMJ B,1FMK A,1FN9 A,1FN9 B,1FNF A,1FNN A,1FNN
 B,1FO3 A,1FO8 A,1FOB A,1FP1 D,1FP2 A,1FP3 A,1FP3 B,1FPO A,1FPO
 B,1FPO C,1FPZ A,1FPZ B,1FPZ C,1FPZ D,1FPZ E,1FPZ F,1FQI A,1FR3
 A,1FR3 B,1FR3 C,1FR3 D,1FR3 E,1FR3 F,1FR3 G,1FR3 H,1FR3 I,1FR3
 J,1FR3 K,1FR3 L,1FS5 A,1FS5 B,1FSG A,1FSG C,1FT5 A,1FTH A,1FTH
 B,1FTH C,1FTR A,1FTR B,1FTR C,1FTR D,1FUK A,1FVG A,1FVI A,1FVM
 A,1FVM B,1FVM C,1FVM D,1FVM E,1FVM F,1FVM G,1FVM H,1FVM I,1FVM
 J,1FVM K,1FVM L,1FX2 A,1FXD A,1FXO A,1FXO B,1FXO C,1FXO D,1FXO
 E,1FXO F,1FXO G,1FXO H,1FYE A,1FZQ A,1FZV A,1FZV B,1G0C A,1G0S
 A,1G0S B,1G12 A,1G1J A,1G1J B,1G1T A,1G29 1,1G29 2,1G2B A,1G2N
 A,1G2O A,1G2O B,1G2O C,1G2Q A,1G2Q B,1G2R A,1G2Y A,1G2Y B,1G2Y
 C,1G2Y D,1G33 A,1G3K A,1G3K B,1G3K C,1G3P A,1G3Q A,1G4I A,1G55
 A,1G57 A,1G57 B,1G5A A,1G5H A,1G5H B,1G5H C,1G5H D,1G5T A,1G60
 A,1G60 B,1G61 A,1G61 B,1G66 A,1G6G A,1G6G B,1G6G E,1G6G F,1G6H
 A,1G6U A,1G6U B,1G6X A,1G7S A,1G87 A,1G87 B,1G8A A,1G8E A,1G8E
 B,1G8F A,1G8K A,1G8K B,1G8K C,1G8K D,1G8K E,1G8K F,1G8K G,1G8K
 H,1G8L A,1G8L B,1G8M A,1G8M B,1G8Q A,1G8Q B,1G94 A,1G9W A,1G9W
 B,1G9W C,1GA6 A,1GA6 I,1GA8 A,1GAI A,1GAK A,1GCI A,1GCI A,1GCI A,1GDE
 A,1GDE B,1GEE A,1GEE B,1GEE E,1GEE F,1GEF A,1GEF B,1GEF D,1GEF
 E,1GEQ A,1GEQ B,1GHE A,1GHE B,1GHG A,1GHG B,1GHG C,1GHG
 D,1GHP A,1GK6 A,1GK6 B,1GK7 A,1GK9 A,1GK9 B,1GKM A,1GKP A,1GKP
 B,1GKP C,1GKP D,1GKP E,1GKP F,1GL2 A,1GL2 B,1GL2 C,1GL2 D,1GL4
 A,1GL4 B,1GMI A,1GMU A,1GMU B,1GMU C,1GMU D,1GMX A,1GNL A,1GNL
 B,1GNL A,1GO3 E,1GO3 F,1GO3 M,1GO3 N,1GO6 A,1GO6 B,1GO6 C,1GO6
 D,1GO6 E,1GO6 F,1GO6 G,1GO6 H,1GO6 I,1GO6 K,1GO6 M,1GO6 O,1GOI
 A,1GOI B,1GP0 A,1GP1 A,1GP1 B,1GP6 A,1GPJ A,1GPP A,1GPR A,1GQ6
 A,1GQ6 B,1GQ6 C,1GQ8 A,1GQA A,1GQA D,1GQE A,1GQV A,1GR0 A,1GR3
 A,1GS5 A,1GS9 A,1GSA A,1GTE A,1GTE B,1GTE C,1GTE D,1GTK A,1GTT
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 D,1GTZ E,1GTZ F,1GTZ G,1GTZ H,1GTZ I,1GTZ J,1GTZ K,1GTZ L,1GU2

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 A,1NSC B,1NSJ A,1NSZ A,1NSZ B,1NTH A,1NTV A,1NTV B,1NTY A,1NU0
 A,1NU0 B,1NU4 A,1NU4 B,1NU5 A,1NUL A,1NUL B,1NUU A,1NUU B,1NUY
 A,1NWA A,1NWW A,1NWW B,1NWZ A,1NXC A,1NXJ A,1NXJ B,1NXJ
 C,1NXM A,1NXM B,1NXU A,1NXU B,1NYC A,1NYC B,1NYK A,1NYK B,1NZ0
 A,1NZ0 B,1NZ0 C,1NZ0 D,1NZA A,1NZI A,1NZI B,1NZJ A,1NZN A,1O04
 A,1O04 B,1O04 C,1O04 D,1O04 E,1O04 F,1O04 G,1O04 H,1O06 A,1O0S
 A,1O0S B,1O0W A,1O0W B,1O0X A,1O13 A,1O1Y A,1O1Z A,1O20 A,1O22
 A,1O2D A,1O2D B,1O3U A,1O4S A,1O4S B,1O4T A,1O4T B,1O4W A,1O4Y
 A,1O50 A,1O54 A,1O5K A,1O5K B,1O5U A,1O5U B,1O5X A,1O5X B,1O63
 A,1O63 B,1O69 A,1O69 B,1O6A A,1O6A B,1O6D A,1O6V A,1O6V B,1O75
 A,1O75 B,1O7I A,1O7I B,1O7J A,1O7J B,1O7J C,1O7J D,1O7Q A,1O7Q
 B,1O7Z A,1O7Z B,1O8V A,1O8X A,1O91 A,1O91 B,1O91 C,1O98 A,1O9G
 A,1O9I A,1O9I B,1O9I C,1O9I D,1O9I E,1O9I F,1OA8 A,1OA8 B,1OA8 C,1OA8
 D,1OAA A,1OAC A,1OAC B,1OAI A,1OAI B,1OAO A,1OAO B,1OAO C,1OAO
 D,1OB4 A,1OB6 A,1OB6 B,1OB7 A,1OB8 A,1OB8 B,1OBB A,1OBB B,1OBO
 A,1OBO B,1OC2 A,1OC2 B,1OC7 A,1OCK A,1OCK B,1OCY A,1OD3 A,1OD6
 A,1ODK A,1ODK B,1ODK C,1ODK D,1ODK E,1ODK F,1ODM A,1ODO
 A,1ODV A,1ODV B,1ODZ A,1ODZ B,1OE8 A,1OE8 B,1OEJ A,1OEY A,1OEY
 A,1OEY B,1OEY C,1OEY D,1OEY J,1OEY K,1OEY L,1OEY M,1OF8 A,1OF8
 B,1OFC X,1OFD A,1OFD B,1OFL A,1OFW A,1OFW B,1OFZ A,1OFZ B,1OGD
 A,1OGD B,1OGD C,1OGD D,1OGD E,1OGO X,1OGQ A,1OH0 A,1OH0
 B,1OH4 A,1OHL A,1OHP A,1OHP B,1OHP C,1OHP D,1OHT A,1OI0 A,1OI0
 B,1OI0 C,1OI0 D,1OI2 A,1OI2 B,1OI6 A,1OI6 B,1OI7 A,1OIH A,1OIH B,1OIH
 C,1OIH D,1OIS A,1OJH A,1OJH B,1OJH C,1OJH D,1OJH E,1OJH F,1OJH
 G,1OJH H,1OJH I,1OJH J,1OJH K,1OJH L,1OJJ A,1OJJ B,1OJQ A,1OK0
 A,1OKI A,1OKI B,1OKS A,1OLL A,1OLR A,1OLZ A,1OLZ B,1ON2 A,1ON2
 B,1ON3 A,1ON3 B,1ON3 C,1ON3 D,1ON3 E,1ON3 F,1ONW A,1ONW B,1OO0
 A,1OO0 B,1OOE A,1OOE B,1OOH A,1OOH B,1OOT A,1OPC A,1OPK A,1OQ1
 A,1OQ1 B,1OQ1 C,1OQ1 D,1OQJ A,1OQJ B,1OQV A,1OQV B,1OQV
 C,1OQW A,1OQW B,1OR0 A,1OR0 B,1OR0 C,1OR0 D,1OR7 A,1OR7 B,1OR7
 C,1OR7 F,1ORR A,1ORR B,1ORR C,1ORR D,1ORU A,1ORU B,1OSD
 A,1OSD B,1OSY A,1OSY B,1OTH A,1OTK A,1OTK B,1OU8 A,1OU8 B,1OU8
 C,1OU8 D,1OU9 A,1OU9 B,1OU9 C,1OUV A,1OUW A,1OUW B,1OUW
 C,1OUW D,1OV3 A,1OV3 B,1OV3 C,1OV3 D,1OW1 A,1OW4 A,1OW4
 B,1OWL A,1OX0 A,1OX3 A,1OXJ A,1OXX K,1OYG A,1OYW A,1OZ2 A,1OZ9
 A,1OZH A,1OZH B,1OZH C,1OZH D,1OZN A,1P0H A,1P0K A,1P0K B,1P0Z
 A,1P0Z B,1P0Z C,1P0Z D,1P0Z E,1P0Z F,1P0Z G,1P0Z H,1P0Z I,1P0Z
 J,1P15 A,1P15 B,1P1J A,1P1J B,1P1L A,1P1M A,1P2F A,1P3C A,1P3D
 A,1P3D B,1P4C A,1P4O A,1P4O B,1P4P A,1P57 A,1P57 B,1P5D X,1P5Z

B,1P6O A,1P6O B,1P6X A,1P6X B,1P77 A,1P90 A,1P99 A,1P9A G,1P9B
A,1P9G A,1P9H A,1P9I A,1PB7 A,1PBE A,1PBJ A,1PBW A,1PBW B,1PBY
A,1PBY B,1PBY C,1PCF A,1PCF B,1PCF C,1PCF D,1PCF E,1PCF F,1PCF
G,1PCF H,1PCH A,1PDO A,1PE9 A,1PE9 B,1PEF A,1PEN A,1PFB A,1PFB
B,1PFZ A,1PFZ B,1PFZ C,1PFZ D,1PG4 A,1PG4 B,1PG6 A,1PGV A,1PGX
A,1PII A,1PJ5 A,1PK3 A,1PK3 B,1PK3 C,1PKH A,1PKH B,1PKO A,1PL3
A,1PL3 B,1PM1 X,1PM4 A,1PM4 B,1PM4 C,1PMH X,1PMI A,1PMM A,1PMM
B,1PMM C,1PMM D,1PMM E,1PMM F,1PN0 A,1PN0 B,1PN0 C,1PN0 D,1PN2
A,1PN2 B,1PN2 C,1PN2 D,1POC A,1POT A,1PP0 A,1PP0 B,1PP0 C,1PP0
D,1PPR M,1PPR N,1PPR O,1PPY A,1PPY B,1PQ4 A,1PQ4 B,1PQ7 A,1PQH
A,1PQH B,1PRZ A,1PSR A,1PSR B,1PSW A,1PT6 A,1PT6 B,1PTF A,1PTQ
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A,1Q0Q A,1Q0Q B,1Q0R A,1Q0U A,1Q0U B,1Q1A A,1Q1A B,1Q1F A,1Q1R
A,1Q1R B,1Q1U A,1Q25 A,1Q2H A,1Q2H B,1Q2H C,1Q2Y A,1Q33 A,1Q35
A,1Q3L A,1Q3L P,1Q3O A,1Q3O B,1Q42 A,1Q4U A,1Q4U B,1Q5D A,1Q5Y
A,1Q5Y B,1Q5Y C,1Q5Y D,1Q5Z A,1Q6H A,1Q6H B,1Q6O A,1Q6O B,1Q6Z
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B,1Q7L C,1Q7L D,1Q8B A,1Q8C A,1Q8D A,1Q8F A,1Q8F B,1Q8F C,1Q8F
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C,1QOW D,1QOW E,1QOW F,1QQ5 A,1QQ5 B,1QQF A,1QQP 1,1QQP
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1QTN S,1QTN T,1QTN U,1QTN V,1QTN W,1QTN X,1QTN Y,1QTN Z,1QU1
A,1QU1 B,1QU1 C,1QU1 D,1QU1 E,1QU1 F,1QU1 G,1QU1 H,1QU1 I,1QU1 J,
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1R0D F,1R0D G,1R0D H,1R0D I,1R0M A,1R0M B,1R0M C,1R0M D,1R0U A,
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1RK6 A,1RKI

A,1RKI B,1RKQ A,1RKQ B,1RKT A,1RKT B,1RKU A,1RKU B,1RL0 A,1RL6
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 C,1RM6 D,1RM6 E,1RM6 F,1RMG A,1RO2 A,1ROC A,1ROW A,1ROW
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 A,1RY9 B,1RY9 C,1RY9 D,1RYB A,1RYI A,1RYI B,1RYI C,1RYI D,1RYL
 A,1RYL B,1RYO A,1RYP 1,1RYP 2,1RYP A,1RYP B,1RYP C,1RYP D,1RYP
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 N,1RYP O,1RYP P,1RYP Q,1RYP R,1RYP S,1RYP T,1RYP U,1RYP V,1RYP
 W,1RYP X,1RYP Y,1RYP Z,1RYQ A,1RZ2 A,1RZ3 A,1S0P A,1S0P B,1S12
 A,1S12 B,1S12 C,1S12 D,1S1D A,1S1D B,1S1F A,1S21 A,1S29 A,1S2O
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 C,1S5U D,1S5U E,1S5U F,1S5U G,1S5U H,1S67 L,1S67 U,1S68 A,1S6C
 A,1S6C B,1S7I A,1S7K A,1S7Z A,1S8N A,1S96 A,1S96 B,1S99 A,1S99
 B,1S9R A,1S9R B,1S9U A,1SAU A,1SBP A,1SBX A,1SBY A,1SBY B,1SBZ
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 B,1STM C,1STM D,1STM E,1SU8 A,1SUM B,1SUR A,1SUU A,1SVB A,1SVF
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 J,1SZO K,1SZO L,1SZW A,1SZW B,1T07 A,1T0B A,1T0B B,1T0B C,1T0B
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 A,1T0H B,1T0I A,1T0I B,1T0T V,1T0T W,1T0T X,1T0T Y,1T0T Z,1T1E A,1T1G
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 J,1TH7 K,1TH7 L,1TH7 M,1TH7 N,1THG A,1THM A,1THX A,1TIB A,1TIF
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B,1TQY C,1TQY D,1TQY E,1TQY F,1TQY G,1TQY H,1TR0 A,1TR0 B,1TR0
C,1TR0 D,1TR0 E,1TR0 F,1TR0 G,1TR0 H,1TR0 I,1TR0 J,1TR0 K,1TR0
L,1TR0 M,1TR0 N,1TR0 O,1TR0 P,1TR0 R,1TR0 S,1TR0 T,1TR0 U,1TR0
V,1TR0 W,1TR0 X,1TR0 Y,1TS9 A,1TT8 A,1TU1 A,1TU1 B,1TU7 A,1TU7
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C,1TWY D,1TWY E,1TWY F,1TWY G,1TWY H,1TXG A,1TXG B,1TXJ A,1TXL
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A,1TZ0 B,1TZ0 C,1TZJ A,1TZJ B,1TZJ C,1TZJ D,1TZP A,1TZP B,1TZV
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B,1U79 C,1U79 D,1U79 E,1U7B A,1U7B B,1U7G A,1U7I A,1U7I B,1U7K
A,1U7K B,1U7K C,1U7K D,1U7K E,1U7K F,1U7L A,1U7P A,1U7P B,1U7P
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A,1U9D B,1U9L A,1U9L B,1U9L C,1U9P A,1UA4 A,1UAI A,1UAN A,1UAN
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C,1UFB D,1UFI A,1UFI B,1UFI C,1UFI D,1UFO A,1UFO B,1UFO C,1UFO
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A,1UOY A,1UOZ A,1UP9 A,1UPI A,1UPK A,1UPK B,1UPQ A,1UPS A,1UPS
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C,1V6T A,1V6Z A,1V6Z B,1V70 A,1V74 A,1V74 B,1V76 A,1V76 B,1V77
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B,1W27 A,1W27 B,1W2F A,1W2F B,1W2I A,1W2I B,1W2L A,1W2W A,1W2W
B,1W2W E,1W2W F,1W2W I,1W2W J,1W2W M,1W2W N,1W2Y A,1W2Y
B,1W32 A,1W32 B,1W3I A,1W3I B,1W3I C,1W3I D,1W3M A,1W3M B,1W3M
C,1W3M D,1W3M E,1W3M F,1W3M G,1W3M H,1W3M I,1W3M J,1W3M
K,1W3M L,1W41 A,1W4R A,1W4R B,1W4R C,1W4R D,1W4R E,1W4R
F,1W4R G,1W4R H,1W4S A,1W4T A,1W4V A,1W4V B,1W4V C,1W4V
D,1W4V E,1W4V F,1W53 A,1W5F A,1W5F B,1W5Q A,1W5Q B,1W5R A,1W5R
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C,1W7R D,1W7R E,1W7R F,1W7R G,1W7R H,1W8K A,1W8O A,1W8S
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A,2X2S A,2X2U A,2X32 A,2X36 A,2X3C A,2X3E A,2X3G A,2X3H A,2X3J
A,2X3L A,2X3M A,2X3N A,2X46 A,2X49 A,2X4D A,2X4J A,2X4K A,2X4L
A,2X55 A,2X5C A,2X5F A,2X5H A,2X5N A,2X5O A,2X5P A,2X5R A,2X5X
A,2X5Y A,2X61 A,2X6U A,2X6W A,2X78 A,2X7K A,2X7M A,2X7Q A,2X7R
A,2X8H A,2X8S A,2X8X X,2X98 A,2X9G A,2X9O A,2X9X A,2X9Z A,2XAU
A,2XB0 X,2XB4 A,2XBG A,2XBK A,2XBL A,2XBT A,2XBU A,2XC1 A,2XCI
A,2XCJ A,2XCZ A,2XD3 A,2XDC A,2XDG A,2XDH A,2XDJ A,2XDP A,2XDW
A,2XE4 A,2XED A,2XEP A,2XET A,2XEU A,2XEV A,2XEX A,2XF7 A,2XFD
A,2XFN A,2XFR A,2XFV A,2XG5 A,2XGR A,2XGT A,2XGU A,2XGV A,2XHA
A,2XHF A,2XHG A,2XHN A,2XI8 A,2XI9 A,2XIG A,2XIJ A,2XIO A,2XJ4 A,2XJH
A,2XJI A,2XJP A,2XKI A,2XKR A,2XLG A,2XM5 A,2XME A,2XMI A,2XMJ
A,2XMO A,2MX A,2XMZ A,2XN2 A,2XN6 A,2XNQ A,2XOC A,2XOD A,2XOL
A,2XOM A,2XOT A,2XOV A,2XPP A,2XPW A,2XQ0 A,2XQH A,2XQO A,2XQQ
A,2XQU A,2XR6 A,2XRH A,2XRW A,2XRY A,2XSA A,2XSE A,2XSF A,2XSG
A,2XSK A,2XSQ A,2XST A,2XSU A,2XSW A,2XT2 A,2XTL A,2XTP A,2XTS
A,2XTY A,2XU3 A,2XU8 A,2XU9 A,2XUA A,2XUS A,2XUV A,2XVE A,2XVM
A,2XVS A,2XVY A,2XW6 A,2XW7 A,2XW9 A,2XWL A,2XWP A,2XWS A,2XWV
A,2XWX A,2XXL A,2XXN A,2XXP A,2XXZ A,2XY1 A,2XY2 A,2XYI A,2XZ2
A,2XZ4 A,2XZ8 A,2XZ9 A,2XZE A,2XZG A,2XZI A,2Y08 A,2Y0C A,2Y0O
A,2Y0T A,2Y1B A,2Y1E A,2Y1N A,2Y24 A,2Y27 A,2Y28 A,2Y2A A,2Y2M
A,2Y2Z A,2Y32 A,2Y3C A,2Y3J A,2Y3K A,2Y3V A,2Y3W A,2Y43 A,2Y44
A,2Y4R A,2Y4Y A,2Y53 A,2Y5C A,2Y5M A,2Y5P A,2Y5S A,2Y6N A,2Y6U
A,2Y6X A.

Supplementary Table S12B. Transmembrane proteins used to compute maximal cliques, size-order and spherical coordinates.

1A0S P,1A0S Q,1A0S R,1A0T P,1A0T Q,1A0T R,2A06 C,2A06 D,2A06 E,2A06 G,2A06 P,2A06 Q,2A06 R,2A06 T,2A06 W,2A0D A,3A0B A,3A0B B,3A0B C,3A0B D,3A0B E,3A0B F,3A0B H,3A0B I,3A0B J,3A0B K,3A0B L,3A0B M,3A0B T,3A0B X,3A0B Y,3A0B N,3A0B Z,3A0B A,3A0B B,3A0B C,3A0B D,3A0B E,3A0B F,3A0B H,3A0B I,3A0B J,3A0B K,3A0B L,3A0B M,3A0B T,3A0B X,3A0B Y,3A0B N,3A0B Z,3A0H A,3A0H B,3A0H C,3A0H D,3A0H E,3A0H F,3A0H H,3A0H I,3A0H J,3A0H K,3A0H L,3A0H M,3A0H T,3A0H X,3A0H Y,3A0H N,3A0H Z,3A0H A,3A0H B,3A0H C,3A0H D,3A0H E,3A0H F,3A0H H,3A0H I,3A0H J,3A0H K,3A0H L,3A0H M,3A0H T,3A0H X,3A0H Y,3A0H N,3A0H Z,4A01 A,4A01 B,1A11 A,3A2S X,3A2S A,3A2S B,4A2N B,5A2N A,5A2N B,5A2O A,5A2O B,3A3Y A,3A3Y B,3A3Y G,4A4M A,4A4M C,5A40 A,5A40 B,5A41 A,5A41 B,5A43 A,5A43 B,5A44 A,5A44 B,5A44 C,5A45 A,5A45 B,5A45 C,2A65 A,2A65 B,5A63 A,5A63 B,5A63 C,5A63 D,5A6E A,5A6E B,5A6G A,5A6G B,5A6U A,5A6U B,5A6U G,3A7K A,3A7K B,3A7K D,4A79 A,4A7A A,4A82 A,4A82 B,5A8E A,1A91 A,2A95 B,2A9H A,2A9H B,2A9H C,2A9H D,4A97 A,4A97 B,4A97 C,4A97 D,4A97 E,4A98 A,4A98 B,4A98 C,4A98 D,4A98 E,2ABM A,2ABM B,2ABM C,2ABM D,3ABK A,3ABK B,3ABK C,3ABK D,3ABK G,3ABK I,3ABK J,3ABK K,3ABK L,3ABK M,3ABK N,3ABK O,3ABK P,3ABK Q,3ABK T,3ABK V,3ABK W,3ABK X,3ABK Y,3ABK Z,3ABL A,3ABL B,3ABL C,3ABL D,3ABL G,3ABL I,3ABL J,3ABL K,3ABL L,3ABL M,3ABL N,3ABL O,3ABL P,3ABL Q,3ABL T,3ABL V,3ABL W,3ABL X,3ABL Y,3ABL Z,3ABM A,3ABM B,3ABM C,3ABM D,3ABM G,3ABM I,3ABM J,3ABM K,3ABM L,3ABM M,3ABM N,3ABM O,3ABM P,3ABM Q,3ABM T,3ABM V,3ABM W,3ABM X,3ABM Y,3ABM Z,3ABV C,3ABV D,3ABW A,3ABW B,3ABW D,5ABB A,5ABB B,5ABB Z,2AC6 A,2ACZ C,2ACZ D,2ACZ G,2ACZ H,2ACZ K,2ACZ L,4AC5 H,4AC5 L,4AC5 M,2AD0 C,2AD0 D,3AE1 C,3AE1 D,3AE2 C,3AE2 D,3AE3 C,3AE3 D,3AE4 C,3AE4 D,3AE5 C,3AE5 D,3AE6 C,3AE6 D,3AE7 C,3AE7 D,3AE8 C,3AE8 D,3AE9 C,3AE9 D,3AEA C,3AEA D,3AEB C,3AEB D,3AEC C,3AEC D,3AED C,3AED D,3AEE C,3AEE D,3AEF C,3AEF D,3AEG C,3AEG D,3AEH A,3AEH B,5AEX A,5AEX B,5AEX C,5AEZ A,5AEZ B,5AEZ C,1AF6 A,1AF6 B,1AF6 C,1AFO A,1AFO B,2AFL A,2AFL B,2AFL C,2AFL D,4AFK A,5AF1 A,5AF1 C,5AF1 D,2AGV A,3AG1 A,3AG1 B,3AG1 C,3AG1 D,3AG1 G,3AG1 I,3AG1 J,3AG1 K,3AG1 L,3AG1 M,3AG1 N,3AG1 O,3AG1 P,3AG1 Q,3AG1 T,3AG1 V,3AG1 W,3AG1 X,3AG1 Y,3AG1 Z,3AG2 A,3AG2 B,3AG2 C,3AG2 D,3AG2 G,3AG2 I,3AG2 J,3AG2 K,3AG2 L,3AG2 M,3AG2 N,3AG2 O,3AG2 P,3AG2 Q,3AG2 T,3AG2 V,3AG2 W,3AG2 X,3AG2 Y,3AG2 Z,3AG3 A,3AG3 B,3AG3 C,3AG3 D,3AG3 G,3AG3 I,3AG3 J,3AG3 K,3AG3 L,3AG3 M,3AG3 N,3AG3 O,3AG3 P,3AG3 Q,3AG3 T,3AG3 V,3AG3 W,3AG3 X,3AG3 Y,3AG3 Z,3AG4 A,3AG4 B,3AG4 C,3AG4 D,3AG4 G,3AG4 I,3AG4 J,3AG4 K,3AG4 L,3AG4 M,3AG4 N,3AG4 O,3AG4 P,3AG4 Q,3AG4 T,3AG4 V,3AG4 W,3AG4 X,3AG4 Y,3AG4 Z,4AGE A,4AGE B,4AGE C,4AGE D,4AGE E,4AGE F,4AGE G,4AGF A,4AGF B,4AGF C,4AGF D,4AGF E,4AGF F,4AGF G,2AH3 A,2AHY A,2AHY B,2AHY C,2AHY D,2AHZ A,2AHZ B,2AHZ C,2AHZ D,5AHY A,5AHY B,5AHY C,5AHZ A,5AHZ B,5AHZ C,7AHL A,7AHL B,7AHL C,7AHL D,7AHL E,7AHL F,7AHL G,1AIG L,1AIG M,1AIG H,1AIJ L,1AIJ M,1AIJ H,4AIN A,4AIN B,4AIN C,4AIP A,4AIP B,4AIP C,4AIQ A,5AJI A,5AJI B,5AJI C,5AJI D,5AJI E,5AJI F,5AJI G,2AKH X,2AKH Y,2AKH Z,2AKH A,2AKH B,2AKH C,2AKI X,2AKI Y,2AKI Z,2AKI A,2AKI B,2AKI C,4AL0 A,4AL0 B,4AL0 C,4AL1 A,4AL1 B,4AL1 C,2AMK A,3AM6 A,3AM6 B,3AM6 C,3AM6 D,4AMI A,4AMJ A,3ANZ A,3ANZ B,3ANZ C,3ANZ D,3ANZ E,3ANZ

F,3ANZ G,5AN8 A,5AN8 B,5AN8 C,5AN8 D,3AOA A,3AOA B,3AOA C,3AOB A,3AOB B,3AOB C,3AOC A,3AOC B,3AOC C,3AOD A,3AOD B,3AOD C,3AOU A,3AOU B,3AOU C,3AOU D,3AOU E,3AOU F,3AOU G,3AOU H,3AOU I,3AOU J,1AP9 A,1AP9 B,1AP9 C,4APS A,3AQP A,4AQ5 A,4AQ5 B,4AQ5 C,4AQ5 D,4AQ5 E,4AQ9 A,4AQ9 B,4AQ9 C,4AQ9 D,4AQ9 E,1AR1 A,1AR1 B,3AR2 A,3AR3 A,3AR4 A,3AR5 A,3AR6 A,3AR7 A,3AR8 A,3AR9 A,5ARA J,5ARA K,5ARA L,5ARA M,5ARA N,5ARA O,5ARA P,5ARA Q,5ARA T,5ARA W,5ARE J,5ARE K,5ARE L,5ARE M,5ARE N,5ARE O,5ARE P,5ARE Q,5ARE T,5ARE W,5ARH J,5ARH K,5ARH L,5ARH M,5ARH N,5ARH O,5ARH P,5ARH Q,5ARH T,5ARH W,5ARI J,5ARI K,5ARI L,5ARI M,5ARI N,5ARI O,5ARI P,5ARI Q,5ARI T,5ARI W,2ASG A,2ASG B,2ASG C,2ASG D,2ASG E,3ASN A,3ASN B,3ASN C,3ASN D,3ASN G,3ASN I,3ASN J,3ASN K,3ASN L,3ASN M,3ASN N,3ASN O,3ASN P,3ASN Q,3ASN T,3ASN V,3ASN W,3ASN X,3ASN Y,3ASN Z,3ASO A,3ASO B,3ASO C,3ASO D,3ASO G,3ASO I,3ASO J,3ASO K,3ASO L,3ASO M,3ASO N,3ASO O,3ASO P,3ASO Q,3ASO T,3ASO V,3ASO W,3ASO X,3ASO Y,3ASO Z,1AT9 A,1AT9 B,1AT9 C,1ATY A,2AT9 A,2AT9 B,2AT9 C,2ATK C,2ATK D,2ATK E,2ATK F,4ATV A,4ATV B,2AUI A,2AUL A,4AU5 A,4AU5 B,2AVL A,4AV3 A,4AV3 B,4AV6 A,4AV6 B,5AVQ A,5AVQ B,5AVQ G,5AVR A,5AVR B,5AVR G,5AVS A,5AVS B,5AVS G,5AVT A,5AVT B,5AVT G,5AVU A,5AVU B,5AVU G,5AVV A,5AVV B,5AVV G,5AVW A,5AVW B,5AVW G,5AVX A,5AVX B,5AVX G,5AVY A,5AVY B,5AVY G,5AVZ A,5AVZ B,5AVZ G,4AW6 B,5AW0 A,5AW0 B,5AW0 G,5AW1 A,5AW1 B,5AW1 G,5AW2 A,5AW2 B,5AW2 G,5AW3 A,5AW3 B,5AW3 G,5AW4 A,5AW4 B,5AW4 G,5AW5 A,5AW5 B,5AW5 G,5AW6 A,5AW6 B,5AW6 G,5AW7 A,5AW7 B,5AW7 G,5AW8 A,5AW8 B,5AW8 G,5AW9 A,5AW9 B,5AW9 G,5AWW Y,5AWW E,5AWW G,5AWZ A,2AXT A,2AXT B,2AXT C,2AXT D,2AXT E,2AXT F,2AXT H,2AXT I,2AXT J,2AXT K,2AXT L,2AXT M,2AXT T,2AXT X,2AXT Z,2AXT A,2AXT B,2AXT C,2AXT D,2AXT E,2AXT F,2AXT H,2AXT I,2AXT J,2AXT K,2AXT L,2AXT M,2AXT T,2AXT X,2AXT Z,5AX0 A,5AX1 A,3AYF A,3AYG A,3AYM A,3AYN A,4AYT A,4AYT B,4AYW A,4AYW B,4AYX A,4AYX B,5AYM A,5AYN A,5AYO A,4AZL A,5AZB A,5AZC A,2B0X A,2B2F A,2B2F B,2B2F C,2B2H A,2B2H B,2B2H C,2B2I A,2B2I B,2B2I C,2B2J A,2B2J B,2B2J C,3B29 A,3B29 B,3B29 C,4B2Q J,4B2Q K,4B2Q L,4B2Q M,4B2Q N,4B2Q O,4B2Q P,4B2Q Q,4B2Q R,4B2Q S,3B44 A,3B45 A,3B4R A,4B4A A,2B5F A,2B5F B,2B5F C,2B5F D,3B5D A,3B5D B,3B5W A,3B5W B,3B5X A,3B5X B,3B5Y A,3B5Y B,3B5Z A,3B5Z B,2B6O A,2B6O I,2B6O J,2B6O K,2B6P A,2B6P B,2B6P C,2B6P D,2B6Q A,2B6R A,2B6S A,2B6U A,2B6V A,3B60 A,3B60 B,3B61 A,4B61 A,2B76 C,2B76 D,2B76 O,2B76 P,4B7O A,3B8C A,3B8E C,3B8E D,3B8E H,1B9U A,3B9B A,3B9R A,3B9W A,3B9W B,3B9W C,3B9Y A,3B9Y B,3B9Y C,3B9Z A,3B9Z B,3B9Z C,1BA4 A,1BAC A,1BAD A,3BA6 A,2BBJ A,2BBJ B,2BBJ D,2BBJ E,2BBJ F,4BBJ A,1BCC C,1BCC D,1BCC E,1BCC G,1BCC J,1BCC M,1BCC N,1BCC P,1BCC R,1BCC U,1BCT A,2BCC C,2BCC D,2BCC E,2BCC G,2BCC J,3BCC C,3BCC D,3BCC E,3BCC G,3BCC J,3BCC M,3BCC N,3BCC P,3BCC R,3BCC U,1BE3 C,1BE3 D,1BE3 E,1BE3 G,1BE3 J,1BE3 K,3BEH A,3BEH B,3BEH C,3BEH D,4BEM A,4BEM B,4BEM C,4BEM D,4BEM E,4BEM F,4BEM G,4BEM H,4BEM I,4BEM J,4BEV A,4BEW A,4BEY A,4BEZ A,4BEZ B,1BGY C,1BGY D,1BGY E,1BGY G,1BGY J,1BGY K,1BGY O,1BGY P,1BGY Q,1BGY S,1BGY V,1BGY W,2BG9 A,2BG9 B,2BG9 C,2BG9 D,2BG9 E,4BGN A,4BGN C,4BGN D,4BGN E,1BH3 A,1BH3 B,1BH3 C,1BHA A,1BHB A,2BHW A,2BHW B,2BHW C,3BHS A,3BHS B,3BHS C,2BK3

A,1BL1 A,1BL8 A,1BL8 B,1BL8 C,1BL8 D,2BL2 A,2BL2 B,2BL2 C,2BL2 D,2BL2 E,2BL2 F,2BL2 G,2BL2 H,2BL2 I,2BL2 J,1BM1 A,1BM1 B,1BM1 C,2BMN A,1BNX A,2BNP A,2BNP B,2BNP C,2BNS A,2BNS B,2BNS C,1BOJ A,1BOK A,2BOB C,2BOB D,2BOB E,2BOB F,2BOC C,2BOC D,2BOC E,2BOC F,2BOZ H,2BOZ L,2BOZ M,4BOG A,4BOG B,4BOG C,4BOG D,4BOG E,4BOI A,4BOI B,4BOI C,4BOI D,4BOI E,4BON A,4BON B,4BON C,4BON D,4BON E,4BOO A,4BOO B,4BOO C,4BOO D,4BOO E,4BOR A,4BOR D,4BOR B,4BOR C,4BOR E,4BOT A,4BOT D,4BOT B,4BOT C,4BOT E,4BPD A,4BPD B,4BPD C,4BPM A,4BPM B,4BPM C,4BPQ A,4BPQ B,5BPS A,5BPS B,5BPS C,5BPS D,5BPS E,5BPS F,5BPS G,5BPS H,5BPS I,5BPS J,5BQ6 A,5BQ6 B,5BQ6 C,5BQ6 D,5BQ6 E,5BQ6 F,5BQ6 G,5BQ6 H,5BQ6 I,5BQ6 J,5BQA A,5BQA B,5BQA C,5BQA D,5BQA E,5BQA F,5BQA G,5BQA H,5BQA I,5BQA J,5BQJ A,5BQJ B,5BQJ C,5BQJ D,5BQJ E,5BQJ F,5BQJ G,5BQJ H,5BQJ I,5BQJ J,1BRD A,1BRD B,1BRD C,1BRR A,1BRR B,1BRR C,1BRX A,1BRX B,1BRX C,2BRD A,2BRD B,2BRD C,3BRY A,3BRZ A,4BRB A,4BRB B,4BRB C,4BRR A,4BRR B,4BRR C,2BS2 C,2BS2 F,2BS3 C,2BS3 F,2BS4 C,2BS4 F,3BS0 A,1BT9 A,1BT9 B,1BT9 C,1BTR A,1BTT A,4BUM X,4BUO A,5BUT I,5BUT J,3BVD A,3BVD B,3BVD C,4BV0 A,4BVN A,4BW5 A,4BW5 B,4BWB A,4BWZ A,5BW8 C,5BW8 D,1BXW A,1BY3 A,1BY5 A,2BY4 A,4BYG A,1BZK A,5BZ2 A,5BZ2 B,5BZ3 A,5BZ3 B,1C0V A,3C02 A,3C02 B,3C02 C,3C02 D,4C00 A,1C17 A,1C17 B,1C17 C,1C17 D,1C17 E,1C17 F,1C17 G,1C17 H,1C17 I,1C17 J,1C17 K,1C17 L,1C17 M,3C1G A,3C1G B,3C1G C,3C1H A,3C1H B,3C1H C,3C1I A,3C1I B,3C1I C,3C1J A,3C1J B,3C1J C,5C1M A,5C2T C,5C2T D,1C3W A,1C3W B,1C3W C,2C32 A,2C32 B,2C32 C,2C32 D,2C3E A,5C3L A,5C3L B,5C3L C,4C48 A,4C48 C,4C48 D,4C48 F,4C48 G,4C48 I,4C4V A,4C4V B,1C51 A,1C51 B,1C51 F,1C51 K,1C51 L,1C51 G,1C51 H,1C51 N,1C51 P,1C51 Q,1C51 R,1C51 S,1C51 W,1C51 Y,1C51 X,5C5X A,5C5X B,5C5X C,5C5X D,2C64 A,2C65 A,2C66 A,2C67 A,4C69 X,5C65 A,5C65 B,5C6N A,5C6O A,5C6P A,2C70 A,2C72 A,2C73 A,2C75 A,2C76 A,4C7R A,4C7R B,4C7R C,5C73 C,5C73 K,5C76 A,5C76 D,5C78 A,5C78 D,1C8R A,1C8R B,1C8R C,1C8S A,1C8S B,1C8S C,2C88 A,2C8K A,2C8L A,5C8J I,1C99 A,2C9M A,3C9L A,3C9M A,4C9G A,4C9H A,4C9J A,4C9Q A,4C9Q B,3CAP A,3CAP B,4CAD C,4CAS B,4CAS C,4CAS D,4CBC A,4CBC B,4CBC G,4CBC H,4CBJ A,4CBJ B,4CBJ C,4CBJ D,4CBJ E,4CBJ F,4CBJ G,4CBJ H,4CBJ I,4CBJ J,4CBJ K,4CBJ L,4CBJ M,4CBK A,4CBK B,4CBK C,4CBK D,4CBK E,4CBK F,4CBK G,4CBK H,4CBK I,4CBK J,4CBK K,4CBK L,4CBK M,4CDI A,4CDI C,4CDI B,4CDI D,4CDI E,4CDI F,2CFP A,2CFQ A,4CFG A,5CFB A,5CFB B,5CFB C,5CFB D,5CFB E,4CG5 A,4CG5 B,4CG5 C,4CG6 A,4CG6 B,4CG6 C,4CG6 D,4CG7 A,4CG7 B,4CG7 C,5CGC A,5CGD A,3CHX A,3CHX B,3CHX C,3CHX M,3CHX E,3CHX F,3CHX G,3CHX N,3CHX I,3CHX J,3CHX K,3CHX O,4CHV A,4CHV B,4CHV C,4CHV D,4CHW A,4CHW B,4CHW C,4CHW D,5CH4 Y,5CH4 E,5CH4 G,3CIR C,3CIR D,3CIR O,3CIR P,4CJZ A,4CJZ B,4CJZ C,4CK0 A,4CK0 B,4CK0 C,1CLT L,1CLT M,3CLL A,3CLL B,3CLL C,3CLL D,3CN5 A,3CN5 B,3CN5 C,3CN5 D,3CN6 A,3CN6 C,3CN6 D,3CN6 E,3COC A,3COC D,3COC C,3COD A,3COD D,3COD C,4COF A,4COF B,4COF C,4COF D,4COF E,2CPB A,2CPS A,4CRT A,3CSL A,3CSN A,4CSK A,4CSK B,4CSK C,4CSK D,4CTD A,5CTG A,5CTG B,5CTG C,5CTH A,5CTH B,5CTH C,4CU4 A,1CWQ A,1CWQ C,1CWQ E,3CWB C,3CWB D,3CWB E,3CWB G,3CWB J,3CWB P,3CWB Q,3CWB R,3CWB T,3CWB W,3CX5 C,3CX5 D,3CX5 E,3CX5 H,3CX5 I,3CX5 N,3CX5 O,3CX5

P,3CX5 S,3CX5 T,3CXH C,3CXH D,3CXH E,3CXH H,3CXH I,3CXH N,3CXH
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 D,2D2C E,2D2C F,2D2C G,2D2C H,2D2C N,2D2C O,2D2C P,2D2C Q,2D2C
 R,2D2C S,2D2C T,2D2C U,4D2B A,4D2C A,4D2D A,4D2E A,4D2E B,4D2E
 C,3D31 C,3D31 D,3D38 H,3D38 L,3D38 M,3D4S A,2D57 A,2D57 B,2D57
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 B,5D56 C,5D57 A,5D57 B,5D57 C,5D58 A,5D59 A,5D5A A,5D5B A,5D5D
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 T,4D6T W,4D6U C,4D6U D,4D6U E,4D6U G,4D6U J,4D6U P,4D6U Q,4D6U
 R,4D6U T,4D6U W,3D9B A,3D9B B,3D9B C,3D9S A,3D9S B,3D9S C,3D9S
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 D,2DB4 E,2DB4 F,2DB4 G,2DB4 H,2DB4 I,2DB4 J,4DBL A,4DBL B,4DCB
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 M,5DN6 N,5DN6 O,5DN6 P,5DN6 Q,5DN6 R,5DN6 S,5DN6 T,5DN6 U,5DN6
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 C,1DS8 L,1DS8 M,1DS8 H,3DSY L,3DSY M,3DSY H,3DTA L,3DTA M,3DTA
 H,3DTR L,3DTR M,3DTR H,3DTS L,3DTS M,3DTS H,3DTU A,3DTU B,3DU2
 L,3DU2 M,3DU2 H,3DU3 L,3DU3 M,3DU3 H,3DUQ L,3DUQ M,3DUQ H,5DUO
 A,5DUO B,1DV3 L,1DV3 M,1DV3 H,1DV6 L,1DV6 M,1DV6 H,4DVE A,2DW3
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 C,2DYS D,2DYS G,2DYS I,2DYS J,2DYS K,2DYS L,2DYS M,2DYS N,2DYS
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 B,1E0P C,1E12 A,1E12 C,1E12 D,1E14 L,1E14 M,1E14 H,4E1S A,4E1T
 A,5E1J A,5E1J B,1E54 A,1E6D L,1E6D M,1E6D H,1E7P C,1E7P F,2E74
 A,2E74 B,2E74 C,2E74 D,2E74 E,2E74 F,2E74 G,2E74 H,2E74 I,2E74 J,2E74
 K,2E74 L,2E74 M,2E74 N,2E74 P,2E74 Q,2E75 A,2E75 B,2E75 C,2E75
 D,2E75 E,2E75 F,2E75 G,2E75 H,2E75 I,2E75 J,2E75 K,2E75 L,2E75 M,2E75
 N,2E75 P,2E75 Q,2E76 A,2E76 B,2E76 C,2E76 D,2E76 E,2E76 F,2E76
 G,2E76 H,2E76 I,2E76 J,2E76 K,2E76 L,2E76 M,2E76 N,2E76 P,2E76 Q,3E83
 A,3E83 C,3E83 D,3E83 E,3E86 A,3E86 C,3E86 D,3E86 E,3E89 A,3E89
 C,3E89 D,3E89 E,3E8B A,3E8B C,3E8B D,3E8B E,3E8F A,3E8F C,3E8F
 D,3E8F E,3E8G A,3E8G C,3E8G D,3E8G E,3E8H A,3E8H C,3E8H D,3E8H
 E,3E9J C,2EAR A,2EAT A,2EAU A,3EAM A,3EAM B,3EAM C,3EAM D,3EAM
 E,4EA3 A,4EEB A,4EEB B,4EEB C,4EEB D,4EEB E,4EED A,4EED B,4EED

C,4EED D,4EED E,3EFF K,3EFF L,3EFF M,3EFF N,3EFM A,3EGW C,3EGW F,1EHK A,1EHK B,1EHK C,3EH3 A,3EH3 B,3EH3 C,3EH4 A,3EH4 B,3EH4 C,3EH5 A,3EH5 B,3EH5 C,3EHB A,3EHB B,3EHZ A,3EHZ B,3EHZ C,3EHZ D,3EHZ E,5EH4 A,5EH4 B,5EH6 A,2EI4 A,2EI4 B,2EI4 C,2EIJ A,2EIJ B,2EIJ C,2EIJ D,2EIJ G,2EIJ I,2EIJ J,2EIJ K,2EIJ L,2EIJ M,2EIJ N,2EIJ O,2EIJ P,2EIJ Q,2EIJ T,2EIJ V,2EIJ W,2EIJ X,2EIJ Y,2EIJ Z,2EIK A,2EIK B,2EIK C,2EIK D,2EIK G,2EIK I,2EIK J,2EIK K,2EIK L,2EIK M,2EIK N,2EIK O,2EIK P,2EIK Q,2EIK T,2EIK V,2EIK W,2EIK X,2EIK Y,2EIK Z,2EIL A,2EIL B,2EIL C,2EIL D,2EIL G,2EIL I,2EIL J,2EIL K,2EIL L,2EIL M,2EIL N,2EIL O,2EIL P,2EIL Q,2EIL T,2EIL V,2EIL W,2EIL X,2EIL Y,2EIL Z,2EIM A,2EIM B,2EIM C,2EIM D,2EIM G,2EIM I,2EIM J,2EIM K,2EIM L,2EIM M,2EIM N,2EIM O,2EIM P,2EIM Q,2EIM T,2EIM V,2EIM W,2EIM X,2EIM Y,2EIM Z,2EIN A,2EIN B,2EIN C,2EIN D,2EIN G,2EIN I,2EIN J,2EIN K,2EIN L,2EIN M,2EIN N,2EIN O,2EIN P,2EIN Q,2EIN T,2EIN V,2EIN W,2EIN X,2EIN Y,2EIN Z,3EI0 A,3EI0 B,3EI0 C,3EI0 D,3EI0 E,4EIJ A,3EJY A,3EJY B,3EJZ A,3EJZ B,4EJ4 A,1EK9 A,1EK9 B,1EK9 C,4EKW A,4EKW B,4EKW E,4EKW F,5EK0 A,5EK0 B,5EK0 C,5EK0 D,5EKE A,5EKE B,5EKE C,5EKE D,5EKP C,5EKP A,5EKP B,5EKP D,5EKQ A,3EML A,3EMN X,3EMO C,3EMO A,3EMO B,4ENE A,4ENE B,4EPA A,1EQ8 A,2ERV A,2ERV B,5ER7 B,5ER7 A,5ER7 C,5ER7 D,5ER7 E,5ER7 F,5ERA B,5ERA A,5ERA C,5ERA D,5ERA E,5ERA F,1ET2 S,1ET3 S,2EVU A,2EVU B,2EVU C,2EVU D,4EV6 A,4EV6 B,4EV6 C,4EV6 D,4EV6 E,2EXW A,2EXW B,2EXY A,2EXY B,1EYS L,1EYS M,1EYS H,1EZV C,1EZV D,1EZV E,1EZV G,1EZV I,1EZV L,1EZV M,1EZV N,1EZV R,1EZV S,2EZ0 A,2EZ0 B,4EYC A,4EYC B,4EYC C,4EYC D,4EYC E,2F1C X,2F1T A,2F1U A,2F1U B,2F1U C,2F1U D,2F1U E,2F1U F,2F1U G,2F1V A,2F1V B,2F2B A,2F2B B,2F2B C,2F2B D,3F3A A,3F3A B,3F3C A,3F3C B,3F3D A,3F3D B,3F3E A,3F3E B,4F35 B,4F35 A,1F4Z A,1F4Z B,1F4Z C,3F48 A,3F48 B,3F4I A,3F4I B,3F4J A,3F4J B,4F4C A,4F4L A,4F4L B,4F4L C,4F4L D,4F4S K,4F4S L,4F4S M,4F4S N,4F4S O,4F4S P,4F4S Q,4F4S R,4F4S S,4F4S T,1F50 A,1F50 B,1F50 C,3F5W C,3F5W D,3F5W E,3F5W F,1F6G A,1F6G B,1F6G C,1F6G D,1F6N L,1F6N M,1F6N H,2F75 A,3F7V C,3F7V D,3F7V E,3F7V F,3F7Y C,3F7Y D,3F7Y E,3F7Y F,1F88 A,1F88 C,4F8H A,4F8H B,4F8H C,4F8H D,4F8H E,5F8U B,5F8U A,2F93 A,2F93 B,2F93 C,2F93 D,2F95 A,2F95 B,2F95 C,2F95 D,4FA7 A,4FA7 B,4FA7 C,4FAA A,4FAA B,4FAA C,1FBB A,1FBB B,1FBB C,1FBK A,1FBK B,1FBK C,2FBW C,2FBW D,3FB5 C,3FB5 D,3FB5 E,3FB5 F,3FB6 C,3FB6 D,3FB6 E,3FB6 F,3FB7 C,3FB7 D,3FB7 E,3FB7 F,3FB8 C,3FB8 E,3FB8 F,3FB8 G,4FBY A,4FBY B,4FBY C,4FBY D,4FBY E,4FBY F,4FBY H,4FBY I,4FBY J,4FBY K,4FBY L,4FBY M,4FBY T,4FBY Y,4FBY X,4FBY Y,4FBY Z,4FBY G,4FBY N,4FBY P,4FBY Q,4FBY R,4FBY S,4FBY W,4FBY A,4FBY B,4FBY C,4FBY D,4FBY E,4FBY G,4FBY M,4FBY J,4FBY K,4FBY L,4FBZ A,4FBZ B,4FBZ C,1FCP A,2FCP A,4FC4 A,4FC4 B,4FC4 C,4FC4 D,4FC4 E,1FDF A,1FDM A,1FE1 A,1FE1 B,1FE1 C,1FE1 D,1FE1 E,1FE1 F,1FE1 G,1FE1 J,1FE1 K,1FE1 L,1FE1 M,1FE1 N,1FE1 O,1FE1 P,1FEP A,2FEC A,2FEC B,2FED A,2FED B,2FEE A,2FEE B,4FE1 A,4FE1 B,4FE1 F,4FE1 I,4FE1 J,4FE1 K,4FE1 L,4FE1 M,4FE1 X,1FFT A,1FFT B,1FFT C,1FFT D,2FF9 A,2FGQ X,2FGQ A,2FGQ B,2FGR A,2FGR C,2FGR E,3FGO A,4FG6 A,4FG6 B,5FGZ A,3FH6 F,3FH6 G,3FHH A,1FI1 A,3FI1 A,3FI1 B,3FID A,3FIP A,4FI3 A,4FI3 B,5FIJ J,5FIJ K,5FIJ L,5FIJ M,5FIJ N,5FIJ O,5FIJ P,5FIJ Q,5FIJ T,5FIJ W,5FIK J,5FIK K,5FIK L,5FIK M,5FIK N,5FIK O,5FIK P,5FIK Q,5FIK T,5FIK W,5FIL J,5FIL K,5FIL L,5FIL M,5FIL N,5FIL

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 B,5FN5 D,5FN5 A,5FN5 C,4FOZ A,3FPB A,3FPS A,4FPD A,4FPD B,4FPD
 C,1FQU A,1FQY A,1FQY B,1FQY C,1FQY D,4FQE A,4FRT A,4FRX A,4FSO
 A,4FSP A,4FT6 A,4FTP A,4FTP B,4FUV A,4FUV B,1FW2 A,1FW3 A,1FW3
 B,3FWL A,1FX8 A,1FX8 B,1FX8 C,1FX8 D,4FXZ A,4FXZ B,2FYN A,2FYN
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 A,4G1U B,2G2A A,3G5U A,3G60 A,3G61 A,3G6B A,3G6B B,3G7F H,3G7F
 L,3G7F M,4G70 A,4G70 B,4G70 C,4G71 A,4G71 B,4G71 C,4G72 A,4G72
 B,4G72 C,4G7Q A,4G7Q B,4G7Q C,4G7R A,4G7R B,4G7R C,4G7S A,4G7S
 B,4G7S C,4G7V S,4G7Y S,2G87 A,4G80 S,4G80 T,1G90 A,3GB7 C,3GB7
 D,3GB7 E,3GB7 F,4GBR A,4GBY A,4GBZ A,4GC0 A,4GCP A,4GCQ A,4GCS
 A,3GD8 A,3GD8 B,3GD8 C,3GD8 D,4GD3 S,4GD3 T,4GD3 Q,4GD3 R,4GD3
 A,4GD3 B,2GE4 A,4GEY A,1GFM A,1GFM B,1GFM C,1GFN A,1GFN B,1GFN
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 C,2GFP A,2GFZ A,4GF4 A,2GIF A,2GIF B,2GIF C,3GI8 C,3GI9 C,3GIA
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 L,2GNU M,3GP6 A,4GP4 A,4GP4 B,4GP4 C,4GP5 A,4GP5 B,4GP5 C,4GP8
 A,4GP8 B,4GP8 C,4GPO A,4GPO B,2GR7 A,2GR7 B,2GR7 C,2GR7 D,2GR7
 E,2GR7 F,2GR8 A,2GR8 C,2GR8 D,2GRX A,4GRV A,2GSK A,2GSM A,2GSM
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 A,3GWW B,4GX0 A,4GX0 B,4GX0 E,4GX0 F,4GX1 A,4GX1 B,4GX1 E,4GX1
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 D,4H0L E,4H0L F,4H0L G,4H0L H,4H0L I,4H0L J,4H0L K,4H0L L,4H0L
 M,4H0L N,4H0L O,4H0L P,3H1H C,3H1H D,3H1H E,3H1H G,3H1H J,3H1H
 P,3H1H Q,3H1H R,3H1H T,3H1H W,3H1I C,3H1I D,3H1I E,3H1I G,3H1I J,3H1I
 P,3H1I Q,3H1I R,3H1I T,3H1I W,3H1J C,3H1J D,3H1J E,3H1J G,3H1J J,3H1J
 P,3H1J Q,3H1J R,3H1J T,3H1J W,3H1K C,3H1K D,3H1K E,3H1K G,3H1K
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 M,4H13 N,4H13 O,4H13 P,4H1D A,4H1D B,4H1D C,4H1W A,4H1W B,1H2S
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 K,4H44 L,4H44 M,4H44 N,4H44 O,4H44 P,1H68 A,1H6I A,1H6S 1,2H88
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E,3KCU A,3KCU B,3KCU C,3KCU D,3KCU E,3KCV A,3KCV B,3KCV C,3KCV

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 D,1OCC G,1OCC I,1OCC J,1OCC K,1OCC L,1OCC M,1OCC N,1OCC
 O,1OCC P,1OCC Q,1OCC T,1OCC V,1OCC W,1OCC X,1OCC Y,1OCC
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 D,1OCR G,1OCR I,1OCR J,1OCR K,1OCR L,1OCR M,1OCR N,1OCR
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 B,4OGQ C,4OGQ D,4OGQ E,4OGQ F,4OGQ G,4OGQ H,4OGQ I,4OGQ
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X,1S5L N,1S5L Z,1S5L A,1S5L B,1S5L C,1S5L D,1S5L E,1S5L F,1S5L
H,1S5L I,1S5L J,1S5L K,1S5L L,1S5L M,1S5L T,1S5L X,1S5L N,1S5L Z,1S6E
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D,1SQV E,1SQV G,1SQV J,1SQV K,1SQX C,1SQX E,1SQX D,1SQX G,1SQX
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 C,4TNH D,4TNH E,4TNH F,4TNH H,4TNH I,4TNH J,4TNH K,4TNH L,4TNH
 M,4TNH T,4TNH Y,4TNH X,4TNH Y,4TNH Z,4TNH A,4TNH B,4TNH C,4TNH
 D,4TNH E,4TNH F,4TNH H,4TNH I,4TNH J,4TNH K,4TNH L,4TNH M,4TNH
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 E,4TNI F,4TNI H,4TNI I,4TNI J,4TNI K,4TNI L,4TNI M,4TNI T,4TNI Y,4TNI
 X,4TNI Y,4TNI Z,4TNI A,4TNI B,4TNI C,4TNI D,4TNI E,4TNI F,4TNI H,4TNI
 I,4TNI J,4TNI K,4TNI L,4TNI M,4TNI T,4TNI G,4TNI X,4TNI G,4TNI Z,4TNJ
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 L,4TNJ M,4TNJ T,4TNJ Y,4TNJ X,4TNJ Y,4TNJ Z,4TNJ A,4TNJ B,4TNJ
 C,4TNJ D,4TNJ E,4TNJ F,4TNJ H,4TNJ I,4TNJ J,4TNJ K,4TNJ L,4TNJ
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 E,4TNK F,4TNK H,4TNK I,4TNK J,4TNK K,4TNK L,4TNK M,4TNK T,4TNK
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 H,4TQQ L,4TQQ M,4TQU M,4TQU N,4TQV A,4TQV B,4TSY A,4TSY B,3TT1
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 B,3U2F C,3U2F D,3U2F E,3U2Y K,3U2Y L,3U2Y M,3U2Y N,3U2Y O,3U2Y
 A,3U2Y B,3U2Y C,3U2Y D,3U2Y E,4U2P A,4U2P B,4U2P D,4U2P C,4U2Q
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 A,3U32 B,3U32 C,3U32 D,3U32 E,4U3F C,4U3F D,4U3F E,4U3F G,4U3F
 J,4U3F P,4U3F Q,4U3F R,4U3F T,4U3F W,4U4F A,4U4F B,4U4F C,4U4F
 D,4U4G A,4U4G B,4U4G C,4U4G D,4U4T A,4U4V A,4U4W A,4U4W B,1U5N
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A,2VDD B,2VDD C,2VDE A,2VDE B,2VDE C,2VDF A,1VF5 A,1VF5 B,1VF5 C,1VF5 D,1VF5 E,1VF5 F,1VF5 G,1VF5 H,1VF5 N,1VF5 O,1VF5 P,1VF5 Q,1VF5 R,1VF5 S,1VF5 T,1VF5 U,1VFP A,1VGO A,1VGO C,1VGO F,3VG9 A,3VGA A,3VHZ A,3VHZ B,3VHZ C,3VI0 A,3VI0 B,3VI0 C,1VJM A,1VJM B,1VJM C,2VL0 A,2VL0 B,2VL0 C,2VL0 D,2VL0 E,3VMQ A,3VMR A,3VMS A,3VMT A,2VOY B,2VOY C,2VOY D,2VOY E,2VOY G,2VOY H,2VOY K,2VOY L,3VOU A,3VOU B,3VOU C,3VOU D,2VPW C,2VPW G,2VPX C,2VPX G,2VPY C,2VPY G,2VPZ C,2VPZ G,2VQI A,1VRN H,1VRN L,1VRN M,1VRY A,2VR0 C,2VR0 F,2VRL A,2VRM A,3VR8 C,3VR8 D,3VR9 C,3VR9 D,3VRA C,3VRA D,3VRB C,3VRB D,2VT4 A,2VV5 A,2VV5 B,2VV5 C,2VV5 D,2VV5 E,2VV5 F,2VV5 G,3VVK A,3VVK B,3VVK C,3VVN A,3VVO A,3VVP A,3VVR A,3VVS A,3VW7 A,3VY8 X,3VY8 A,3VY8 B,3VY9 X,3VY9 A,3VY9 B,1VZ1 A,3VZT X,3VZT A,3VZT B,3VZU X,3VZU A,3VZU B,3VZW X,3VZW A,3VZW B,2W0F C,2W0F D,2W0F E,2W0F F,2W16 A,2W1B A,2W1B B,2W1B C,2W1P A,2W1P B,2W1P C,2W1P D,2W2E A,2W2E B,2W2E C,2W2E D,3W4T A,1W5C A,1W5C B,1W5C C,1W5C D,1W5C E,1W5C F,1W5C G,1W5C H,1W5C I,1W5C J,1W5C K,1W5C L,1W5C X,1W5C Y,2W5J A,2W5J B,2W5J C,2W5J D,2W5J E,2W5J F,2W5J G,2W5J H,2W5J I,2W5J J,2W5J K,2W5J L,2W5J M,2W5J V,3W5A A,3W5A C,3W5B A,3W5C A,3W5D A,2W6T A,2W6U A,4W6V A,2W75 A,2W76 A,2W77 A,2W78 A,3W9H A,3W9H B,3W9H C,3W9I A,3W9I B,3W9I C,3W9J A,3W9J B,3W9J C,3W9T A,3W9T C,3W9T G,3W9T B,3W9T F,3W9T E,3W9T D,1WAZ A,3WAZ A,3WAK A,4WAB A,4WAB B,4WAV A,3WBN A,2WDQ C,2WDQ D,2WDQ G,2WDQ H,2WDQ K,2WDQ L,2WDR C,2WDR D,2WDR G,2WDR H,2WDV C,2WDV D,2WDV G,2WDV H,2WDV K,2WDV L,3WDO A,4WD7 A,4WD7 B,4WD7 C,4WD7 D,4WD7 E,4WD8 A,4WD8 B,4WD8 C,4WD8 D,4WD8 E,3WFB B,3WFB C,3WFC B,3WFC C,3WFD B,3WFD C,3WFE B,3WFE C,4WFE A,4WFE B,4WFF A,4WFF B,4WFG A,4WFG B,4WFG H,4WFG B,2WGM A,2WGM B,2WGM C,2WGM D,2WGM E,2WGM F,2WGM G,2WGM H,2WGM I,2WGM J,2WGM K,3WG7 A,3WG7 B,3WG7 C,3WG7 D,3WG7 G,3WG7 I,3WG7 J,3WG7 K,3WG7 L,3WG7 M,3WG7 N,3WG7 O,3WG7 P,3WG7 Q,3WG7 T,3WG7 V,3WG7 W,3WG7 X,3WG7 Y,3WG7 Z,3WGU C,3WGU D,3WGU E,3WGV C,3WGV D,3WGV E,4WGV A,4WGV C,4WGW A,4WGW C,2WIE A,2WIE B,2WIE C,2WIE D,2WIE E,2WIE F,2WIE G,2WIE H,2WIE I,2WIE J,2WIE K,2WIE L,2WIE M,2WIE N,2WIE P,2WIT A,2WIT B,2WIT C,3WI4 A,3WI4 B,3WI4 C,3WI5 A,3WI5 B,3WI5 C,4WIB A,4WIB B,4WIS A,4WIS B,4WIT A,4WIT B,2WJK A,2WJK B,2WJK C,2WJL A,2WJL B,2WJL C,2WJM H,2WJM L,2WJM M,2WJN H,2WJN M,2WJN L,2WJQ A,2WJR A,2WLH A,2WLH B,2WLH C,2WLH D,2WLI A,2WLI B,2WLI D,2WLI E,2WLJ A,2WLJ B,2WLJ C,2WLJ D,2WLK A,2WLK B,2WLK C,2WLK D,2WLL A,2WLL B,2WLL C,2WLL D,2WLM A,2WLM B,2WLM C,2WLM D,2WLN A,2WLN B,2WLN C,2WLN D,2WLO A,2WLO B,3WME A,3WME B,3WMF A,3WMF B,3WMM A,3WMM L,3WMM M,3WMM H,3WMM A,3WMM B,3WMM D,3WMM E,3WMM F,3WMM G,3WMM I,3WMM J,3WMM K,3WMM N,3WMM O,3WMM P,3WMM R,3WMM S,3WMM T,3WMM U,3WMM V,3WMM W,3WMM X,3WMM Y,3WMM Z,3WMM 1,3WMM 2,3WMM 3,3WMM 4,3WMM 5,3WMM 6,3WMM 7,3WMM 8,3WMM 9,3WMM 0,4WMZ A,3WO6 A,3WO7 A,4WO1 A,4WOL A,4WOL B,1WP1 A,1WP1 C,1WP1 D,1WPG A,2WP9 C,2WP9 D,2WP9 G,2WP9 H,2WP9 K,2WP9 L,2WPD J,2WPD K,2WPD L,2WPD M,2WPD N,2WPD O,2WPD P,2WPD Q,2WPD R,2WPD S,2WQY C,2WQY D,3WQJ A,3WQJ B,3WQJ C,1WRG

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 R,2WSC 1,2WSC 2,2WSC 3,2WSC 4,2WSE A,2WSE B,2WSE F,2WSE
 G,2WSE H,2WSE I,2WSE J,2WSE K,2WSE L,2WSE R,2WSE 1,2WSE
 2,2WSE 3,2WSE 4,2WSF A,2WSF B,2WSF F,2WSF G,2WSF H,2WSF I,2WSF
 J,2WSF K,2WSF L,2WSF R,2WSF 1,2WSF 2,2WSF 3,2WSF 4,2WSW
 A,2WSW B,2WSW C,2WSX A,2WSX B,2WSX C,1WU0 A,2WU2 C,2WU2
 D,2WU2 G,2WU2 H,2WU2 K,2WU2 L,2WU5 C,2WU5 D,2WU5 G,2WU5
 H,2WU5 K,2WU5 L,3WU2 A,3WU2 B,3WU2 C,3WU2 D,3WU2 E,3WU2
 F,3WU2 H,3WU2 I,3WU2 J,3WU2 K,3WU2 L,3WU2 M,3WU2 T,3WU2 Y,3WU2
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 B,2X2V C,2X2V D,2X2V E,2X2V F,2X2V G,2X2V H,2X2V I,2X2V J,2X2V
 K,2X2V L,2X2V M,3X29 A,3X2Q A,3X2Q B,3X2Q C,3X2Q D,3X2Q G,3X2Q
 I,3X2Q J,3X2Q K,3X2Q L,3X2Q M,3X2Q N,3X2Q O,3X2Q P,3X2Q Q,3X2Q
 T,3X2Q V,3X2Q W,3X2Q X,3X2Q Y,3X2Q Z,3X2R D,3X2R A,3X2R B,3X2R
 C,3X2R E,3X2R F,3X2R G,3X2R H,3X2R I,4X2S A,4X2S B,4X2S C,3X3B
 A,3X3B B,3X3C A,3X3C B,4X31 A,4X31 B,4X31 C,4X32 A,4X32 B,4X32
 C,2X4M A,2X55 A,2X56 A,2X5U H,2X5U L,2X5U M,2X5V H,2X5V M,2X5V
 L,4X5M B,4X5M C,4X5N A,4X5N B,4X5T A,4X5T B,4X5T C,4X5T D,4X5T
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 A,2X6C B,2X6C C,2X6C D,2X72 A,2X72 C,2X79 A,2X9K A,4XDJ A,4XDJ
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 A,2XE3 C,2XE3 D,2XE5 A,2XE5 B,2XE5 C,4XEE A,4XES A,1XFH A,1XFH
 B,1XFH C,2XFN A,2XFO A,2XFP A,2XFQ A,2XFU A,2XG6 A,2XG6 B,2XG6
 C,1XIO A,1XIO B,4XIG M,4XIG N,1XJI A,1XKH A,1XKW A,4XK8 A,4XK8
 B,4XK8 F,4XK8 G,4XK8 H,4XK8 I,4XK8 J,4XK8 K,4XK8 L,4XK8 1,4XK8
 2,4XK8 3,4XK8 4,1XL4 A,1XL4 B,1XL4 C,1XL4 D,1XL6 A,1XL6 B,1XL6 C,1XL6
 D,1XME A,1XME B,1XME C,2XMN A,2XMN B,2XMN C,1XNU A,1XNU B,1XNU
 C,1XNU D,1XNU E,2XND J,2XND K,2XND L,2XND M,2XND N,2XND O,2XND
 P,2XND Q,4XNI A,4XNJ A,4XNK A,4XNL A,4XNU A,4XNV A,4XNW A,4XNX
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D,2ZXW G,2ZXW I,2ZXW J,2ZXW K,2ZXW L,2ZXW M,2ZXW N,2ZXW
O,2ZXW P,2ZXW Q,2ZXW T,2ZXW V,2ZXW W,2ZXW X,2ZXW Y,2ZXW
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The PDB ID is followed by the chain ID used in this study.

II. Supplemental Figures

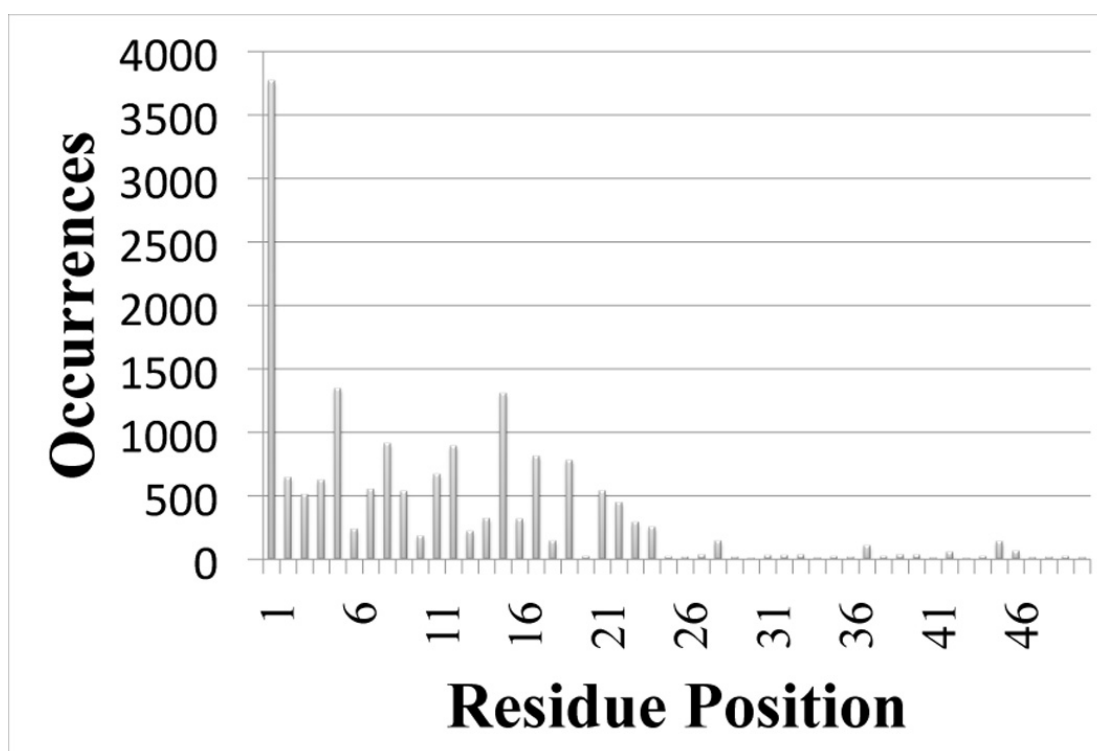


Figure S1. Distribution of identified mutants over HokC sequence. The number of mutants observed (Occurrences, Y axis) at every residue position (X axis) along the HokC sequence are presented as histograms.

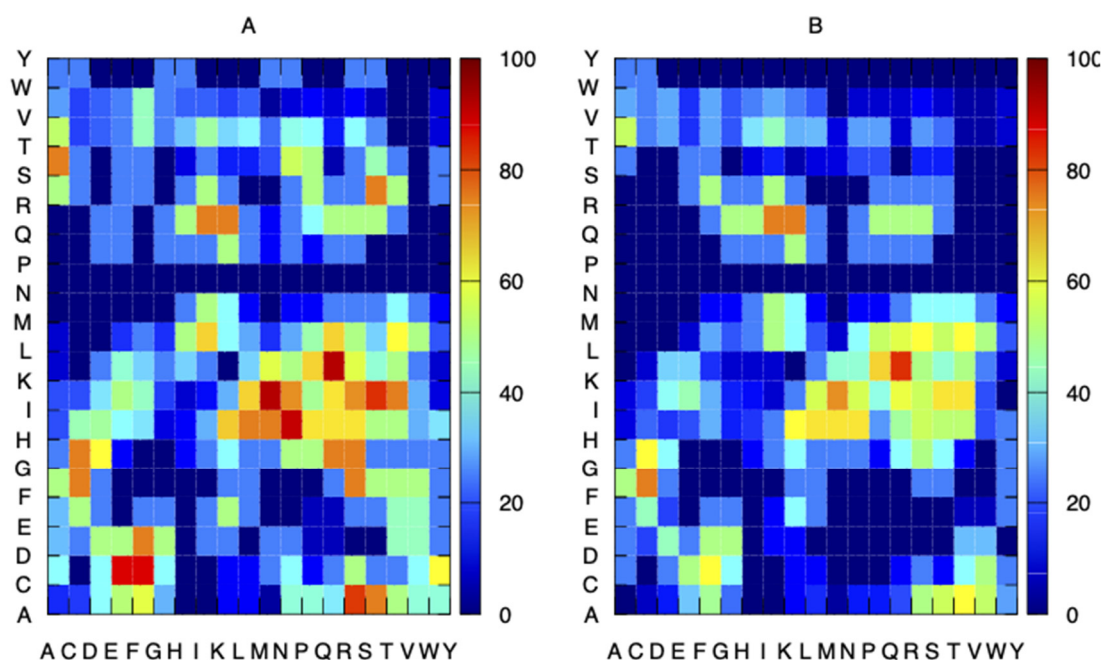


Figure S2. Heat map for HokC substitutions. The frequency of every substitution (Y axis) on any of the original HokC amino acids (X axis) rendering a wild-type (A) and mutant (B) phenotype are represented by a color scale, where the dark blue represent the lowest frequency and dark red the highest. The data for this figure was derived from Table S3A and S3B.

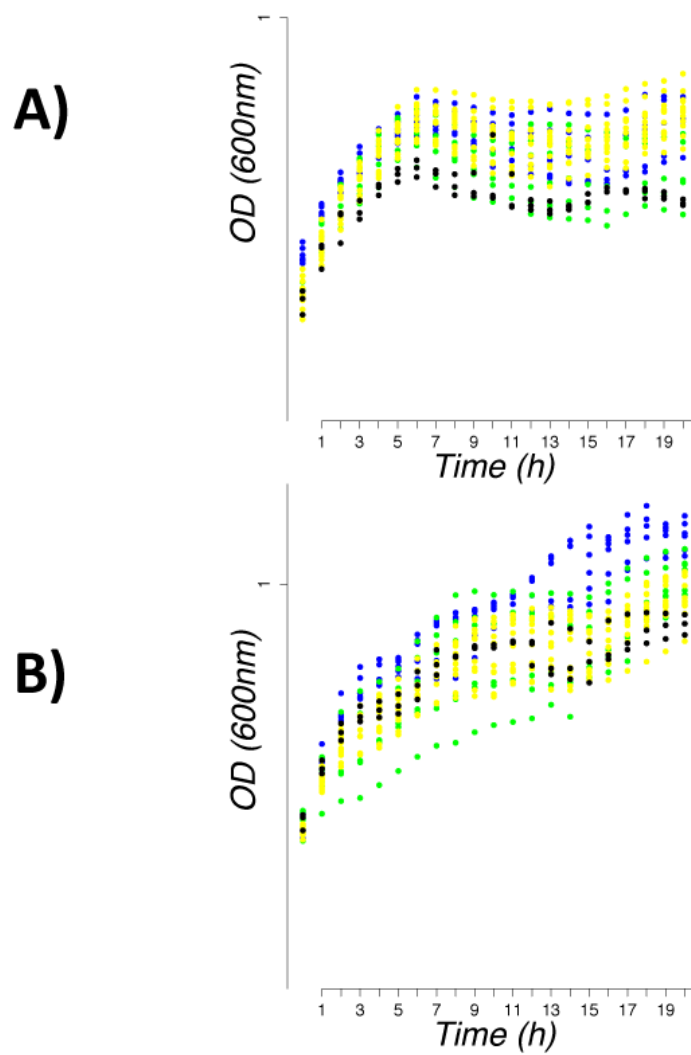


Figure S3. Cell growth of HokC fusions. *E. coli* cells expressing HokC (black circles) or any selected variant were grown to reach 0.4-0.5 of optical density (OD)

measured at 600 nm in rich media and then were exposed to an inducer of HokC-GFP (IPTG) or HokC-phoA (Arabinose) expression. The image presents in colored circles each variant: Met7Trp (blue circles), Ile12Ser (green), Met7Trp-Ile12Ser (yellow). **A)** Optical density measured during 20 h for cells expressing HokC, or any of its variants, fused to GFP. **B)** Optical density measured during 20 h for cells expressing HokC, or any of its variants, fused to phoA. Each panel presents the results of 5 independent experimental results.

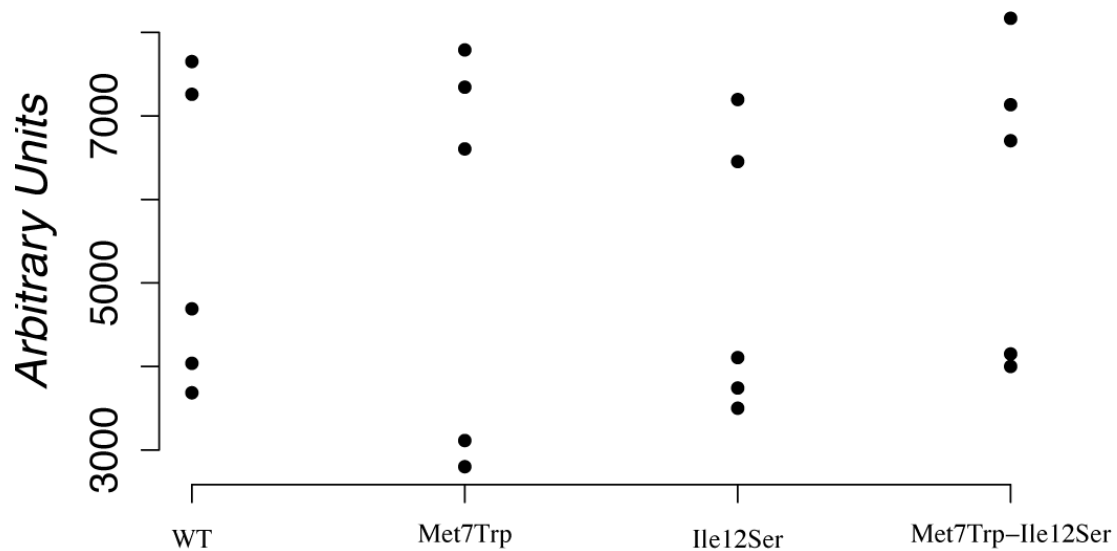


Figure S4. Phosphatase activity measured on cells expressing HokC or variants. Arbitrary units of phosphatase activity measured on cells expressing HokC, HokC:Met7Trp, HokC:Ile12Ser or HokC:Met7Trp-Ile12Ser. Please refer to Methods for the details on how this activity was measured.