Properties of subunit a substitutions

Location and Mutation	Growth on glucose[a]	Growth on succinate[b] *mm*	% Quenching with ATP[c]	+Ag/-Ag[d]	+NEM/-NEM[d]
WT[d]	100	2.0 - 2.8	65-85	0.80-1.00	0.90-1.00
TMH 1					
W39C	102	2.3	78 ± 1	0.79 ± 0.03	0.92 ± 0.00
T40C	102	2.6	78 ± 0	0.89 ± 0.01	0.94 ± 0.01
I41C	103	2.3	76 ± 1	0.86 ± 0.02	0.95 ± 0.08
N42C	93	2.2	68 ± 3	0.86 ± 0.00	1.00 ± 0.08
I43C	93	2.4	65 ± 5	0.93 ± 0.03	0.98 ± 0.02
D44C	93	2.0	45 ± 3	0.26 ± 0.03	0.33 ± 0.04
S45C	100	2.2	68 ± 9	0.90 ± 0.06	1.03 ± 0.01
M46C	101	2.4	70 ± 6	0.99 ± 0.00	1.01 ± 0.05
F47C	101	2.2	68 ± 8	1.01 ± 0.04	1.02 ± 0.08
F48C	100	2.2	71 ± 3	0.98 ± 0.02	0.93 ± 0.03
S49C	100	2.4	71 ± 1	0.99 ± 0.07	1.02 ± 0.11
V50C	99	2.2	69 ± 9	0.87 ± 0.15	0.98 ± 0.18
V51C	100	2.0	79 ± 8	0.96 ± 0.02	0.97 ± 0.02
L52C	98	2.3	70 ± 6	0.92 ± 0.00	0.97 ± 0.06
G53C	100	2.7	69 ±12	0.94 ± 0.10	1.02 ± 0.17
L54C	99	2.0	55 ± 0	1.00 ± 0.03	1.02 ± 0.09
L55C	99	2.0	67 ± 8	0.88 ± 0.02	0.96 ± 0.08
F56C	100	2.1	58 ± 2	0.99 ± 0.02	1.07 ± 0.04
L57C	100	2.2	68 ±10	0.93 ± 0.15	0.98 ± 0.12
V58C	97	2.2	58 ± 2	0.90 ± 0.10	1.01 ± 0.10
L59C	98	2.2	65 ±12	0.89 ± 0.07	1.01 ± 0.14
F60C	97	2.2	62 ± 8	0.91 ± 0.09	0.91 ± 0.06
R61C	99	2.2	66 ± 1	0.97 ± 0.00	0.94 ± 0.03
S62C	102	2.5	78 ± 1	0.91 ± 0.01	0.96 ± 0.03
1-2 loop					
V63C	101	2.0	85 ± 1	1.00 ± 0.01	0.98 ± 0.00
A64C	100	2.2	82 ± 0	0.96 ± 0.00	0.96 ± 0.00
K65C	107	2.2	80 ± 2	1.01 ± 0.02	0.98 ± 0.04
K66C	105	2.2	71 ± 2	0.93 ± 0.04	0.91 ± 0.02
A67C	100	2.0	77 ± 1	0.99 ± 0.02	1.00 ± 0.01

T68C	104	2.0	80 ± 0	1.01 ± 0.01	0.97 ± 0.01
S69C	100	2.0	73 ± 4	1.11 ± 0.08	1.08 ± 0.07
G70C	101	2.1	67 ± 3	0.98 ± 0.03	0.95 ± 0.06
V71C	99	2.1	71 ± 4	1.05 ± 0.03	1.03 ± 0.01
P72C	101	2.0	70 ± 6	0.90 ± 0.02	0.90 ± 0.08
G73C	108	2.0	73 ± 3	0.98 ± 0.05	0.99 ± 0.00
K74C	100	2.2	84 ± 0	1.01 ± 0.01	0.98 ± 0.00
F75C	105	2.0	70 ± 7	0.99 ± 0.06	0.93 ± 0.04
Q76C	107	2.0	84 ± 1	1.00 ± 0.01	0.97 ± 0.01
T77C	103	2.0	69 ± 7	0.95 ± 0.04	0.97 ± 0.05
A78C	103	2.0	70 ± 5	1.00 ± 0.03	0.98 ± 0.06
I79C	101	2.0	68 ± 4	0.90 ± 0.01	0.95 ± 0.00
E80C	99	2.0	84 ± 1	1.00 ± 0.02	0.97 ± 0.00
L81C	111	2.0	75 ± 4	0.87 ± 0.04	0.99 ± 0.04
V82C	99	1.9	70 ± 5	0.93 ± 0.04	0.86 ± 0.06
I83C	108	2.0	75 ± 3	0.95 ± 0.01	1.00 ± 0.05
G84C	102	1.8	66 ± 3	0.62 ± 0.06	0.87 ± 0.01
F85C	108	2.0	74 ± 1	0.87 ± 0.06	0.91 ± 0.05
V86C	102	2.0	68 ± 2	0.17 ± 0.03	0.91 ± 0.04
N87C	112	2.0	76 ± 1	0.93 ± 0.04	0.97 ± 0.03
G88C	104	2.0	71 ± 1	0.87 ± 0.10	0.98 ± 0.05
S89C	99	2.3	71 ± 2	0.93 ± 0.00	0.92 ± 0.06
V90C	102	2.3	68 ± 5	0.47 ± 0.04	0.94 ± 0.00
K91C	98	2.0	71 ± 2	0.86 ± 0.01	0.97 ± 0.03
D92C	105	2.1	66 ± 4	0.79 ± 0.07	1.00 ± 0.03
M93C	105	2.0	67 ± 3	0.12 ± 0.00	0.88 ± 0.04
Y94C	100	2.1	70 ± 3	0.84 ± 0.00	0.93 ± 0.08
H95C	103	2.2	67 ± 6	0.93 ± 0.04	0.87 ± 0.03
G96C	112	2.6	77 ± 1	0.84 ± 0.02	0.90 ± 0.01
K97C	100	2.1	78 ± 3	0.92 ± 0.05	0.94 ± 0.03
S98C	100	2.2	76 ± 2	0.89 ± 0.05	0.95 ± 0.02
K99C	111	2.4	76 ± 2	0.95 ± 0.03	0.95 ± 0.01
L100C	100	2.2	73 ± 3	0.90 ± 0.04	0.93 ± 0.03
I101C	100	2.4	76 ± 1	0.57 ± 0.06	0.96 ± 0.02
A102C	105	2.4	74 ± 2	0.94 ± 0.03	0.98 ± 0.01

TMH 2					
P103C	99	2.4	74 ± 2	0.84 ± 0.06	0.98 ± 0.02
L104C	100	2.4	74 ± 2	0.83 ± 0.01	0.97 ± 0.01
A105C	100	2.4	72 ± 1	0.81 ± 0.04	0.98 ± 0.03
L106C	102	2.1	77 ± 0	0.58 ± 0.04	0.96 ± 0.04
T107C	101	2.1	72 ± 3	0.86 ± 0.04	0.98 ± 0.04
E108C	99	2.2	75 ± 2	0.98 ± 0.01	0.99 ± 0.01
F109C	100	2.1	74 ± 0	0.96 ± 0.01	1.00 ± 0.04
V110C	100	2.1	63 ± 2	0.86 ± 0.04	0.97 ± 0.01
W111C	103	2.1	65 ± 3	0.76 ± 0.04	0.97 ± 0.01
V112C	98	2.1	63 ± 1	0.65 ± 0.09	0.99 ± 0.01
F113C	103	2.1	63 ± 1	0.77 ± 0.08	0.98 ± 0.01
L114C	108	2.0	78 ± 1	0.90 ± 0.01	0.98 ± 0.02
M115C	100	2.1	66 ± 3	0.25 ± 0.07	0.96 ± 0.05
N116C	104	2.1	64 ± 2	0.17 ± 0.05	0.98 ± 0.02
L117C	98	2.1	80 ± 0	0.95 ± 0.01	1.00 ± 0.01
M118C	104	2.3	75 ± 1	0.82 ± 0.03	0.99 ± 0.01
D119C	82	1.6	36 ± 2	0.07 ± 0.01	0.82 ± 0.05
L120C	96	2.0	64 ± 3	0.08 ± 0.01	0.97 ± 0.02
L121C	100	2.0	78 ± 1	0.78 ± 0.01	0.97 ± 0.01
P122C	106	2.0	69 ± 6	0.21 ± 0.02	0.98 ±0.03
E123C	96	2.1	74 ± 2	0.84 ± 0.04	0.99 ± 0.02
D124C	109	2.0	75 ± 4	0.65 ± 0.03	0.95 ±0.02
2-3 loop					
L125C	109	2.1	70 ± 2	0.52 ± 0.02	0.99 ± 0.03
L126C	99	2.0	61 ± 3	0.22 ± 0.02	0.99 ± 0.05
P127C	95	2.0	76 ± 1	0.57 ± 0.03	0.97 ± 0.03
Y128C	99	2.3	73 ± 5	0.81 ± 0.03	0.97 ± 0.01
I129C	100	2.4	73 ± 2	0.87 ± 0.05	0.97 ± 0.00
A130C	100	2.4	71 ± 2	0.48 ± 0.07	0.98 ± 0.03
E131C	100	2.5	69 ± 1	0.84 ± 0.01	0.96 ± 0.03
H132C	99	2.1	74 ± 6	0.83 ± 0.05	0.97 ± 0.02
V133C	99	2.3	71 ± 4	0.88 ± 0.06	0.97 ± 0.01
L134C	106	2.1	70 ± 3	0.88 ± 0.04	1.00 ± 0.01
G135C	100	2.2	59 ± 3	0.77 ± 0.06	0.91 ± 0.09
L136C	113	2.4	54 ± 4	0.44 ± 0.02	0.93 ± 0.15

P137C	100	2.1	64 ± 4	0.77 ± 0.01	0.91 ± 0.07
A138C	101	2.0	74 ± 1	0.87 ± 0.03	0.96 ± 0.01
TMH 3					
L139C	97	2.5	65	0.69	0.98
R140C	99	2.0	69 ± 6	0.39 ± 0.05	0.93 ± 0.04
V141C	100	1.5	77 ± 9	0.76 ± 0.04	0.87 ± 0.12
V142C	100	2.5	74 ± 3	0.79 ± 0.02	0.96 ± 0.05
P143C	101	2.5	69 ± 3	0.79 ± 0.01	0.96 ± 0.06
S144C	101	2.4	72 ± 5	0.24 ± 0.08	0.96 ± 0.02
A145C	101	2.3	70 ± 3	0.71 ± 0.12	0.96 ± 0.04
D146C	96	2.0	70 ± 3	0.44 ± 0.01	0.33 ± 0.06
V147C	90	2.0	70 ± 2	0.80 ± 0.03	1.00 ± 0.02
N148C	99	2.0	70 ± 2	0.81 ± 0.06	0.97 ± 0.02
V149C	99	2.3	73 ± 1	0.89 ± 0.03	0.97 ± 0.01
T150C	102	2.5	68 ± 4	0.89 ± 0.03	0.99 ± 0.01
L151C	101	2.5	71 ± 0	0.87 ± 0.03	0.96 ± 0.06
S152C	101	2.3	71 ± 1	0.93 ± 0.01	1.00 ± 0.06
M153C	101	2.4	68 ± 4	0.90 ± 0.04	0.95 ± 0.01
A154C	100	2.5	69 ± 1	0.93 ± 0.02	0.97 ± 0.02
L155C	100	2.3	60 ± 4	0.82 ± 0.03	0.89 ± 0.01
G156C	100	2.3	67 ± 6	0.90 ± 0.06	0.95 ± 0.03
V157C	101	2.4	72 ± 1	0.90 ± 0.03	0.96 ± 0.04
F158C	101	2.2	69 ± 2	0.72 ± 0.09	0.97 ± 0.01
3-4 loop					
I159C	101	2.2	69 ± 4	0.93 ± 0.03	0.97 ± 0.00
L160C	100	2.3	64 ± 2	0.97 ± 0.17	1.04 ± 0.05
I161C	99	2.3	70 ± 4	0.55 ± 0.16	1.00 ± 0.00
L162C	99	2.2	67 ± 2	0.59 ± 0.14	1.01 ± 0.08
F163C	99	2.2	69 ± 8	0.88 ± 0.00	1.00 ± 0.09
Y164C	88	2.0	74 ± 4	0.80 ± 0.05	0.91 ± 0.05
S165C	99	2.1	69 ± 7	0.51 ± 0.10	0.95 ± 0.00
I166C	100	2.2	73 ± 0	0.75 ± 0.06	0.94 ± 0.06
K167C	99	2.1	74 ± 1	0.85 ± 0.06	0.94 ± 0.08
M168C	99	2.4	70 ± 5	0.96 ± 0.03	0.97 ± 0.05
K169C	99	2.3	70 ± 5	0.90 ± 0.10	0.94 ± 0.04
G170C	99	2.5	73 ± 3	0.78 ± 0.05	0.94 ± 0.03

I171C	100	2.6	47 ± 6	1.19 ± 0.01	1.43 ± 0.11
G172C	100	2.1	69 ± 4	0.97 ± 0.07	1.07 ± 0.03
G173C	101	2.6	69 ± 3	0.83 ± 0.01	0.91 ± 0.04
F174C	101	2.4	55 ±16	0.68 ± 0.12	1.09 ± 0.30
T175C	100	2.3	73 ± 5	0.76 ± 0.04	0.97 ± 0.03
K176C	100	2.3	70 ± 1	0.90 ± 0.09	0.99 ± 0.02
E177C	100	2.1	58 ±14	0.85 ± 0.26	1.09 ± 0.15
L178C	99	2.5	68 ± 3	0.61 ± 0.05	0.96 ± 0.04
T179C	99	2.4	70 ± 0	0.24 ± 0.01	0.96 ± 0.01
L180C	100	2.3	75 ± 4	0.90 ± 0.05	0.97 ± 0.01
Q181C	100	2.1	73 ± 0	0.79 ± 0.12	0.92 ± 0.04
P182C	98	2.2	59 ± 5	0.67 ± 0.31	0.74 ± 0.22
F183C	99	2.2	74 ± 1	0.69 ± 0.24	0.75 ± 0.21
N184C	99	2.4	75 ± 0	0.75 ± 0.05	0.84 ± 0.00
H185C	104	2.3	68 ± 1	0.85 ± 0.10	0.92 ± 0.12
W186C	100	2.7	65 ± 3	0.96 ± 0.06	0.98 ± 0.02
A187C	101	2.7	65 ± 3	0.88 ± 0.07	0.98 ± 0.04
F188C	100	2.7	64 ± 0	0.74 ± 0.17	0.97 ± 0.04
I189C	101	2.3	64 ± 0	0.55 ± 0.12	0.96 ± 0.08
P190C	101	2.5	69 ± 4	0.48 ± 0.02	0.93 ± 0.10
V191C	106	2.5	63 ± 5	0.36 ± 0.02	0.98 ± 0.07
N192C	99	1.9	42 ± 3	0.33 ± 0.00	0.92 ± 0.04
L193C	91	2.2	70 ± 8	0.37 ± 0.08	0.99 ± 0.09
I194C	95	2.2	67 ± 5	0.27 ± 0.01	1.02 ± 0.06
L195C	94	2.1	59 ± 3	0.06 ± 0.01	0.95 ± 0.20
E196C	89	2.0	73 ± 8	0.18 ± 0.01	0.92 ± 0.08
G197C	97	2.2	75 ± 6	0.67 ± 0.03	0.96 ± 0.01
V198C	92	2.2	74 ± 5	0.11 ± 0.06	0.96 ± 0.03
S199C	99	2.3	71 ± 3	0.13 ± 0.01	0.97 ± 0.05
L200C	99	2.2	72 ± 3	0.83 ± 0.03	0.96 ± 0.04
L201C	99	2.0	73 ± 1	0.42 ± 0.08	0.96 ± 0.03
S202C	97	2.2	69 ± 1	0.06 ± 0.00	0.89 ± 0.09
TMH 4					
K203C	97	2.1	67 ± 2	0.03 ± 0.03	0.91 ± 0.05
P204C	97	2.0	70 ± 2	0.56 ± 0.10	0.96 ± 0.04
V205C	99	2.1	68 ± 3	0.67 ± 0.06	0.97 ± 0.02

S206C	103	2.5	73 ± 3	0.05 ± 0.03	0.13 ± 0.02
L207C	83	1.5	35 ± 9	0.27 ± 0.07	0.67 ± 0.09
G208C	107	1.5	81 ± 4	0.92 ± 0.12	0.96 ± 0.02
L209C	99	3.1	41 ± 8	0.60 ± 0.06	1.02 ± 0.05
R210C	50	0	3 ± 2	--	--
L211C	107	2.8	69 ±10	0.93 ± 0.11	0.97 ± 0.17
F212C	99	2.5	74 ±14	0.99 ± 0.02	0.99 ± 0.27
G213C	67	1.2	9 ± 2	0.24 ± 0.20	1.02 ± 0.26
N214C	99	2.1	52 ±11	0.09 ± 0.04	0.18 ± 0.05
M215C	102	1.8	73 ± 2	0.05 ± 0.01	0.95 ± 0.16
Y216C	102	2.0	39 ± 2	0.50 ± 0.06	1.33 ± 0.29
A217C	104	2.6	71 ±22	0.48 ± 0.05	1.18 ± 0.23
G218C	93	2.6	42 ± 2	0.16 ± 0.09	1.17 ± 0.23
E219C	63	0.2	26 ± 3	0.32 ± 0.06	1.02 ± 0.14
L220C	93	2.1	42 ±17	0.36 ± 0.09	1.31 ± 0.20
I221C	102	2.8	75 ± 7	0.71 ± 0.09	1.04 ± 0.03
F222C	107	2.5	71 ± 2	0.63 ± 0.03	1.02 ± 0.03
I223C	104	2.9	67 ± 5	0.74 ± 0.24	1.02 ± 0.11
L224C	102	2.7	58 ±14	0.76 ± 0.04	0.97 ± 0.27
4-5 loop					
I225C	99	2.1	71 ± 5	0.81 ± 0.06	0.90 ± 0.05
A226C	100	2.1	72 ± 2	0.70 ± 0.08	0.95 ± 0.01
G227C	102	2.1	65 ± 5	0.84 ± 0.09	0.98 ± 0.10
L228C	100	2.2	73 ± 5	0.74 ± 0.08	0.94 ± 0.03
L229C	98	2.1	74 ± 5	0.83 ± 0.07	0.96 ± 0.03
P230C	96	2.1	64 ± 3	0.72 ± 0.02	0.94 ± 0.02
W231C	100	2.1	71 ± 3	0.86 ± 0.03	0.95 ± 0.06
W232C	73	2.1	67 ± 6	0.81 ± 0.08	0.93 ± 0.04
S233C	100	2.0	72 ± 2	0.81 ± 0.14	0.96 ± 0.02
Q234C	107	2.2	73 ± 5	0.84 ± 0.10	0.98 ± 0.02
W235C	105	2.0	77 ± 0	0.87 ± 0.01	0.99 ± 0.01
I236C	100	2.0	80 ± 1	0.97 ± 0.02	0.98 ± 0.00
L237C	107	2.1	69 ± 6	0.91 ± 0.05	0.96 ± 0.02
N238C	100	2.0	74 ± 1	0.94 ± 0.02	0.92 ± 0.05

TMH 5					
V239C	99	2.2	73 ± 1	0.92 ± 0.04	0.95 ± 0.01
P240C	100	2.2	78 ± 1	0.93 ± 0.02	0.97 ± 0.01
W241C	103	2.1	72 ± 1	0.40 ± 0.05	0.92 ± 0.06
A242C	99	2.0	74 ± 2	0.70 ± 0.07	0.96 ± 0.01
I243C	113	2.1	75 ± 2	0.87 ± 0.05	0.97 ± 0.01
F244C	104	2.1	62 ± 3	0.35 ± 0.03	1.02 ± 0.04
D119H/H245C	94	1.9	71 ± 7	0.56 ± 0.01	1.04 ± 0.12
I246C	98	2.2	71 ± 2	0.79 ± 0.07	0.92 ± 0.10
L247C	104	2.1	77 ± 1	0.57 ± 0.01	0.97 ± 0.02
I248C	102	2.1	70 ± 5	0.18 ± 0.04	0.62 ± 0.09
I249C	97	2.0	74 ± 1	0.07 ± 0.03	1.00 ± 0.02
T250C	98	2.0	75 ± 3	0.86 ± 0.03	0.95 ± 0.05
L251C	99	2.1	62 ± 4	0.20 ± 0.02	0.90 ± 0.06
Q252C	91	1.8	30 ± 2	0.09 ± 0.01	0.74 ± 0.06
A253C	100	2.1	78 ± 3	0.93 ± 0.05	0.98 ± 0.02
F254C	108	2.2	71 ± 4	0.89 ± 0.06	0.98 ± 0.06
I255C	98	2.2	73 ± 3	0.80 ± 0.07	0.99 ± 0.04
P256C	111	2.2	73 ± 3	0.94 ± 0.00	1.00 ± 0.04
M257C	100	2.0	75 ± 4	0.91 ± 0.10	0.98 ± 0.08
V258C	101	2.0	75 ± 5	0.83 ± 0.03	0.98 ± 0.05
L259C	100	2.0	71 ± 6	0.87 ± 0.01	0.96 ± 0.02
T260C	101	2.5	73 ± 3	0.99 ± 0.01	0.99 ± 0.00
C-terminus					
I261C	111	2.0	71 ± 4	0.75 ± 0.04	0.98 ± 0.01
V262C	111	2.2	70 ± 3	0.28 ± 0.02	0.25 ± 0.02
Y263C	99	2.2	67 ± 3	0.11 ± 0.00	0.76 ± 0.03
L264C	100	2.0	75 ± 8	0.43 ± 0.02	0.96 ± 0.03
S265C	113	2.2	73 ± 9	0.95 ± 0.05	0.96 ± 0.01
M266C	101	2.2	82 ± 1	0.58 ± 0.01	0.97 ± 0.01
A267C	100	2.1	75 ± 3	0.91 ± 0.15	0.87 ± 0.09
S268C	108	2.3	80 ± 1	0.97 ± 0.02	0.99 ± 0.01
E269C	109	2.2	75 ± 3	0.85 ± 0.07	0.98 ± 0.04
E270C	106	2.2	64 ± 1	0.65 ± 0.02	0.94 ± 0.02
Δunc	55	0			

[a] Yield in liquid minimal media containing 0.04% glucose, expressed as a percentage of growth relative to the cysteine-less control.

[b] Colony size after incubation for 72 h on minimal medium plates containing 22 mM succinate. Colonies from the cysteine-less control strain show average colony sizes of 2.4 ± 0.3 mm.

[c] Measured in a buffer containing 10 mM Hepes-KOH pH 7.5, 1 mM $Mg(NO_3)_2$, 10 mM KNO_3.

[d] The results presented are the average of two or more determinations ± S.D. The most silver sensitive residues are highlighted in color: red (>85% inhibition) and orange (66-85% inhibition).