



COMPARATIVE RNA WEB SITE AND PROJECT THE GUTELL

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LAB RNA Mutations (Triman Database)

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Search Results

Total Results: 1022

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
1	16S	96080.1	153		168	HELIX	134693704	C to U	E. coli	562	1	(With U1192) Spcts recessive. b	Triman, K., Becker, E., Dammel, C., Katz, J., Mori, H., Douthwaite, S., Yapjajakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	1
2	16S	96080.1	146		176	HELIX	134693668	G to A	E. coli	562	1	(With U1192) Spcs.b Double mutant (G146A/C176U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	2
3	16S	96080.1	146		176	HELIX	134693668	G to A	E. coli	562	1	(With U1192) Spcs recessive. b	Triman, K., Becker, E., Dammel, C., Katz, J., Mori, H., Douthwaite, S., Yapjajakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	3
4	16S	96080.1	52		359	HELIX	134693272	C to U	E. coli	562	1	(With U1192) Restores Spc growth abolished by G359A alone. b Double mutant (C52U/G359A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	4
5	23S	96092.1	33		0	MULTISTEM	134737504	C to U	E. coli	562	1	Suppressor of temperature-sensitive protein L24 mutation. a	Nishi, K. and Schnier, J. (1986) EMBO J. 5, 1373-1376.	5
6	16S	96080.1	23		11	HELIX	134693020	C to U	E. coli	562	1	Dominant cold-sensitive phenotype and a defetive maturation of the 16S rRNA 5' end.	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486.	6
7	16S	96080.1	23		11	HELIX	134693020	C to U	E. coli	562	1	Cold-sensitive dominant. b	Dammel, C.S. and Noller, H.F. (1993). Genes and Development 7, 660-670.	7
8	16S	96080.1	19		916	HELIX-KNOT	134693056	A to C	E. coli	562	1	30% residuak activity. b	Poot R.A., van den Worm S.H.E, Pleij C.W.A., van Duin J. 1998. Base complementarity in helix 2 of the central psuedoknot in 16S rRNA is essential for ribosome functioning. Nucleic Acids Research 26 (2): 549-553.	8
9	16S	96080.1	18		917	HELIX-KNOT	134693056	C to U	E. coli	562	1	Translational activity restored. b Double mutant (C18U / G917A).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	9
10	16S	96080.1	18		917	HELIX-KNOT	134693056	C to G	E. coli	562	1	Translational activity restored. b Double mutant (C18G / G917C).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	10

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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11	16S	96080.1	18		917	HELIX-KNOT	134693056	C to A	E. coli	562	1	Translational activity restored. b Double mutant (C18A / G917U).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	11
12	16S	96080.1	18		917	HELIX-KNOT	134693056	C to U	E. coli	562	1	Dramatic reduction in translational activity.b	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	12
13	16S	96080.1	18		917	HELIX-KNOT	134693056	C to G	E. coli	562	1	Dramatic reduction in translational activity.b	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	13
14	16S	96080.1	18		917	HELIX-KNOT	134693056	C to A	E. coli	562	1	Dramatic reduction in translational activity.b	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	14
15	16S	96080.1	18		917	HELIX-KNOT	134693056	C to A	E. coli	562	1	Inhibits translation. Mutant 30S particles are impaired in forming 70S tight couples.	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	15
16	16S	96080.1	17		918	HELIX-KNOT	134693056	U to C	E. coli	562	1	30% decrease in CAT activity. b	Poot R.A., van den Worm SHE, Pleij CWA, van Duin J. 1998. Base complementarity in helix 2 of the central psuedoknot in 16S rRNA is essential for ribosome functioning. Nucleic Acids Research 26 (2): 549-553.	16
17	16S	96080.1	153		168	HELIX	134693704	C to U	E. coli	562	1	(With U1192) Spcts.b Double mutant (C153U/G168A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	17
18	16S	96080.1	168		153	HELIX	134693704	G to A	E. coli	562	1	(With U1192) Spcts.b Double mutant (G168A/C153U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	18
19	16S	96080.1	176		146	HELIX	134693668	C to U	E. coli	562	1	(With U1192) Spcs.b Double mutant (C176U/G146A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	19
20	16S	96080.1	189		0	HAIRPIN	134697628	A to G	E. coli	562	1	No effect on S20 binding. c Double mutant (A189G/A190G).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	20
21	16S	96080.1	190		0	HAIRPIN	134697628	A to G	E. coli	562	1	No effect on S20 binding. c Double mutant (A190G/A189G).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	21
22	16S	96080.1	250		0	BULGE	134697808	A to G	E. coli	562	1	Abolished S20 binding.c Double mutant (A250G/G251A).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	22
23	16S	96080.1	251		0	BULGE	134697808	G to A	E. coli	562	1	Abolished S20 binding.c Double mutant (G251A/A250G).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	23
24	16S	96080.1	321		332	HELIX	134694064	A to C	E. coli	562	1	Abolished S20 binding. c	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	24

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25	16S	96080.1	321		332	HELIX	134694064	A to G	E. coli	562	1	Abolished S20 binding. c	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	25
26	16S	96080.1	321		332	HELIX	134694064	A to C	E. coli	562	1	Abolished S20 binding.c Double mutant (A321C/G322U).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	26
27	16S	96080.1	321		332	HELIX	134694064	A to G	E. coli	562	1	Abolished S20 binding.c Double mutant (A321G/G322A).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	27
28	16S	96080.1	322		0	HAIRPIN	134697952	C to A	E. coli	562	1	Abolished S20 binding.c	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	28
29	16S	96080.1	322		0	HAIRPIN	134697952	G to A	E. coli	562	1	Abolished S20 binding.c Double mutant (G322A/A321G).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	29
30	16S	96080.1	322		0	HAIRPIN	134697952	G to U	E. coli	562	1	Abolished S20 binding.c Double mutant (G322U/A321C).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	30
31	16S	96080.1	323		0	HAIRPIN	134697952	U to G	E. coli	562	1	Abolished S20 binding. c	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	31
32	16S	96080.1	332		321	HELIX	134694064	G to A	E. coli	562	1	Abolished S20 binding. c	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	32
33	16S	96080.1	339		350	HELIX	134694100	C to U	E. coli	562	1	(With U1192) Spcts.b Double mutant (C339U/G350A)	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	33
34	16S	96080.1	350		339	HELIX	134694100	G to A	E. coli	562	1	(With U1192) Spcts recessive. b	Triman, K., Becker, E., Dammell, C., Katz, J., Mori, H., Douthwaite, S., Yapijakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	34
35	16S	96080.1	350		339	HELIX	134694100	G to A	E. coli	562	1	(With U1192) Spcts.b Double mutant (G350A/C339U)	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	35
36	16S	96080.1	352		0	MULTISTEM	134700508	C to U	E. coli	562	1	No effect on S20 binding. c Double mutant (C352U/A353G).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	36
37	16S	96080.1	353		0	MULTISTEM	134700508	A to G	E. coli	562	1	No effect on S20 binding. c Double mutant (A353G/C352U).	Cormack, R.S. and Mackie, G.A. (1991). J. Biol. Chem. 266, 18525-18529.	37
38	16S	96080.1	359		52	HELIX	134693272	G to A	E. coli	562	1	(With U1192) Spcs recessive. b	Triman, K., Becker, E., Dammell, C., Katz, J., Mori, H., Douthwaite, S., Yapijakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	38
39	16S	96080.1	359		52	HELIX	134693272	G to A	E. coli	562	1	(With U1192) Restores Spc growth abolished by G359A alone. b Double mutant (G359A/C52U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	39
40	23S	96092.1	424		268	HELIX	134724976	G to A	E. coli	562	1	Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. b	O'Connor, Connor, M., Brunelli, C. A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	40
41	16S	96080.1	505		526	HELIX-KNOT	134694532	G to U	E. coli	562	1	(With U1192) streptomycin at elevated temperature; cold-sensitive growth on ampicillin; Spccs. b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	41
42	16S	96080.1	505		526	HELIX-KNOT	134694532	G to C	E. coli	562	1	(With U1192) streptomycins. b Double mutant (G505C/G506C).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	42
43	16S	96080.1	506		525	HELIX-KNOT	134694532	G to A	E. coli	562	1	(With U1192) lethal under control of natural promoter. b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	43
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44	16S	96080.1	506		525	HELIX-KNOT	134694532	G to A	E. coli	562	1	(With U1192) U525 suppresses severe growth defect of A506; A 506 suppresses the weak growth defect of U525; streptomycins. b Double mutant (G506A/C525U).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	44
45	16S	96080.1	506		525	HELIX-KNOT	134694532	G to C	E. coli	562	1	(With U1192) streptomycins. b Double mutant (G506C/G505C).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	45
46	16S	96080.1	507		524	HELIX-KNOT	134694532	C to U	E. coli	562	1	(With U1192) reduced growth at elevated temperatures on ampicilin; streptomycin. b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	46
47	16S	96080.1	507		524	HELIX-KNOT	134694532	C to U	E. coli	562	1	(With U1192) reduced growth at elevated temperatures; streptomycin; slight stimulation of growth at elevated temperatures in the presence of streptomycin. b Double mutant (C507U/G524A).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	47
48	16S	96080.1	517		0	INTERNAL	134698384	G to A	S. cerevisiae	4932		Increased sensitivity to streptomycin in S. cerevisiae.	Chernoff, U.O., Vincent, A., and Liebman, A.W. (1994). Embo J. 13, 96-913.	48
49	16S	96080.1	517		0	INTERNAL	134698384	G to A	Yeast mitochondria	4932	3	Ochre nonsense suppressor in yeast mitochondria.	Shen, Z. and Fox, T.D. (1989) Nucleic Acids Res. 17: 4534-4539.	49
50	16S	96080.1	517	a	0	INTERNAL	134698384	G to A	E. coli	562	1	Increased level of translational errors; G517A had most deleterious effect on cell growth. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). Nucleic Acids Res. 20, 4221-4227.	50
51	16S	96080.1	517	a	0	INTERNAL	134698384	G to C	E. coli	562	1	Increased level of translational errors; G517A had most deleterious effect on cell growth. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). Nucleic Acids Res. 20, 4221-4227.	51
52	16S	96080.1	517	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Increased level of translational errors; G517A had most deleterious effect on cell growth. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). Nucleic Acids Res. 20, 4221-4227.	52
53	16S	96080.1	517	a	0	INTERNAL	134698384	G to A	E. coli	562	1	Increased translational error rate. b Increased level of chemical modification at positions 530, 531 and 532 in 70S ribosomes.c	O'Connor et al., 1992; Van Ryk and Dahlberg, 1995; O'Connor et al., 1995.	53
54	16S	96080.1	517	a	0	INTERNAL	134698384	G to C	E. coli	562	1	Increased translational error rate. b Increased level of chemical modification at positions 530, 531 and 532 in 70S ribosomes.c	O'Connor et al., 1992; Van Ryk and Dahlberg, 1995; O'Connor et al., 1995.	54
55	16S	96080.1	517	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Increased translational error rate. b Increased level of chemical modification at positions 530, 531 and 532 in 70S ribosomes.c	O'Connor et al., 1992; Van Ryk and Dahlberg, 1995; O'Connor et al., 1995.	55
56	16S	96080.1	517	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Increased level of translational errors. b Double mutant (G517U/U534G).	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). Nucleic Acids Res. 20, 4221-4227.	56
57	16S	96080.1	517	a	0	INTERNAL	134698384	U to A	E. coli	562	1	Polysome formation severely inhibited while tight couple formation was not disturbed.	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	57
58	16S	96080.1	517	a	0	INTERNAL	134698384	del G	E. coli	562	1	Increased level of translational errors. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). Nucleic Acids Res. 20, 4221-4227.	58
59	16S	96080.1	523		0	BULGE	134698420	A to C	Chlamydomonas reinhardtii	3055	2	Streptomycin resistance in chloroplast of Chlamydomonas reinhardtii.	Gauthier, A., Turmel, M. and Lemieux, C. (1988) Mol. Gen. Genet. 214: 192-197.	59
60	16S	96080.1	523		0	BULGE	134698420	A to C	Chlamydomonas reinhardtii	3055	2	Streptomycin resistance in chloroplast of Chlamydomonas reinhardtii.	Harris, E.H., Burkhardt, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	60

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61	16S	96080.1	523		0	BULGE	134698420	A to C	E. coli	562	1	Streptomycinr. b	Melancon, P., Lemieux, C., and Brakier-Gingras, L. (1988). Nucleic Acids Res. 16, 9631-9639.	61
62	16S	96080.1	524		507	HELIX-KNOT	134694532	G to A	E. coli	562	1	(With U1192) lethal under natural promoter. b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	62
63	16S	96080.1	524		507	HELIX-KNOT	134694532	G to A	E. coli	562	1	(With U1192) reduced growth at elevated temperatures; streptomycin; slight stimulation of growth at elevated temperatures in the presence of streptomycin. b Double mutant (G524A/C507U).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	63
64	16S	96080.1	525		506	HELIX-KNOT	134694532	C to A	Nicotiana	4085	2	Streptomycin resistance in Nicotiana chloroplast.	Etzold et al., 1987.	64
65	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	Chlamydomonas reinhardtii	3055	2	Low level streptomycin resistance in chloroplast of Chlamydomonas reinhardtii	Harris, E.H., Burkhardt, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	65
66	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	Euglena gracilis	3039	2	Streptomycin resistance in Euglena gracilis chloroplast.	Montandon, P.E., Nicholas, P., Schurman, P. and Stutz, E. (1985) Nucleic Acids Res. 13: 4299-4310.	66
67	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	Nicotiana	4085	2	Streptomycin resistance in Nicotiana chloroplast	Fromm, H., Galun, E. and Edelman, M. (1989) Plant Molecular Biology 12:499-505.	67
68	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	Nicotiana	4085	2	Streptomycin resistance in tobacco chloroplast	Fromm, H., Galun, E. and Edelman, M. (1989) Plant Molecular Biology 12:499-505.	68
69	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	E. coli	562	1	Streptomycin; (With U1192) slightly Spcts b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	69
70	16S	96080.1	525		506	HELIX-KNOT	134694532	C to G	E. coli	562	1	Lethal. b Double mutant (C525G/C526G).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	70
71	16S	96080.1	525		506	HELIX-KNOT	134694532	C to U	E. coli	562	1	(With U1192) U525 suppresses severe growth defect of A506; A506 suppresses the weak growth defect of U525; streptomycins. b Double mutant (C525U/C506A).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	71
72	16S	96080.1	526		505	HELIX-KNOT	134694532	C to A	E. coli	562	1	(With U1192) reduced cell growth on ampicillin; Spcs. b	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	72
73	16S	96080.1	526		505	HELIX-KNOT	134694532	C to U	N. plumbaginifolia	4092		Extra PvuII site in region coding for 530-loop in N. plumbaginifolia.	Yeh, K.C., To, K.Y., Sun, S.W., Wu, M.C., Lin, T.Y., and Chen, C.C. (1994). Curr. Genet. 26, 132-135.	73
74	16S	96080.1	526		505	HELIX-KNOT	134694532	C to A	E. coli	562	1	(With U1192) suppression of U505 effects; streptomycins. b Double mutant (C526A/G505U).	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	74
75	16S	96080.1	526		505	HELIX-KNOT	134694532	C to G	E. coli	562	1	Lethal. b Double mutant (C526G/C525G)	Powers, T. and Noller, H.F. (1991) EMBO J. 10, 2203-2214.	75
76	16S	96080.1	527	a	522	HELIX	134694604	G to A	E. coli	562	1	Lethal, found in all ribosome fractions.	Santer, M. and Santer, U. (personal communication)	76
77	16S	96080.1	527	a	522	HELIX	134694604	G to C	E. coli	562	1	Lethal, found in all ribosome fractions.	Santer, M. and Santer, U. (personal communication)	77
78	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Little or no effect on cell or inducible beta-galactosidase production. Mutant rRNA found significantly only in free 30S ribosomes. b	Santer, U. V., Tate, D., Canfield, S., Kansil, S., and Santer, M. (1993a). FASEB J. 7, A1093.	78
79	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Lethal, found in polysome. Double mutant (G527U/A149C)	Santer, M. and Santer, U. (personal communication)	79
80	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Like G527U. Double mutant (G527U/A1492G).	Santer, M. and Santer, U. (personal communication)	80

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
81	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Lethal, found in polysome. Double mutant (G527U/A1492U).	Santer, M. and Santer, U. (personal communication)	81
82	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Like G527U. Double mutant (G527U/A1493C).	Santer, M. and Santer, U. (personal communication)	82
83	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Lethal, found in polysome. Double mutant (G527U/A1493G).	Santer, M. and Santer, U. (personal communication)	83
84	16S	96080.1	527	a	522	HELIX	134694604	G to U	E. coli	562	1	Like G527U. Double mutant (G527U/A1493U).	Santer, M. and Santer, U. (personal communication)	84
85	16S	96080.1	528	a	521	HELIX	134694604	C to G	E. coli	562	1	Lethal when fully expressed.	Santer, M. and Santer, U. (personal communication)	85
86	16S	96080.1	529	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Stimulates initiation from a non-AUG initiation codon.	O'Connell, Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	86
87	16S	96080.1	529	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Highly deleterious effect on cell growth; depression of inducible beta-galactosidase production. Leads to irreversible cessation of growth when incorporated into less than 25% of the polysome ribosomes. b	1) Santer, U. V., Tate, D., Canfield, S., Kansil, S., and Santer, M. (1993a). FASEB J. 7, A1093. 2) Santer, U.V., Cekleniak, J.A. and Santer, M. (1993b). Molecular Biology of the Cell 4, 420a.	87
88	16S	96080.1	529	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Lethal; severe reduction of translational accuracy. b	Santer, U.V., Cekleniak, J., Kansil, S., Santer, M., O'Connell, Connor, M. and Dahlberg, A.E. (1995a) RNA 1: 89-94.	88
89	16S	96080.1	530	a	0	INTERNAL	134698384	G to A	E. coli	562	1	No increase in initiation from non-AUG codons. Double mutant (G530A/A531G).	O'Connell, Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	89
90	16S	96080.1	530	a	0	INTERNAL	134698384	G to A	E. coli	562	1	Dominant lethal. b Impaired interaction between ribosomes and ternary complex; EF-Tu-ribosome interaction affected. c	1) Powers, T. and Noller, H.F. (1993). Proc. Natl. Acad. Sci. U.S.A. 90, 1364-1368. 2) Powers, T. and Noller, H.F. (1994) Trends in Genetics. 10, 27-31.	90
91	16S	96080.1	530	a	0	INTERNAL	134698384	G to U	E. coli	562	1	Dominant lethal. b Impaired A-site function. c	Santer, M., Santer, U., Nurse, K., Bakin, A., Cunningham, P., Zain, M., O'Connell, D.O., and Ofengand, J. (1993). Biochemistry 32, 5539-5547.	91
92	16S	96080.1	530		0	INTERNAL	134698384	G to U	E. coli	562	1	Showed a hyperractivity toward kethoxal and a strong reactivity toward CMCT; kethoxal reactivity disappears; reactivity of adjacent G529 disappears. c	Moine H, Nurse K, Ehresmann B, Ehresmann C, Ofengand J. 1997. Conformational Analysis of Escherichia coli 30S Ribosomes Containing the Single-Base Mutations G530U, U1498G, G1401C, and C1501G and the Double-Base Mutation G1401C/C1501G. Biochemistry 36: 137	92
93	16S	96080.1	530		0	INTERNAL	134698384	loop	E. coli	562	1	Interacted unfavorably around the start codon and in the elongation region of the messengers. a	Mendoza L, Mondragon M, Lagunez-Otero J. 1998. Interaction of the 530 ribosomal site with regions of mRNA. BioSystems 46: 293-298.	93

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
94	16S	96080.1	531		0	INTERNAL	134698384	U to G	E. coli	562	1	No effect on growth or protein synthesis when incorporated into 50% or more of the ribosomes in the polysome fraction. b	Santer, M., Santer, U., Nurse, K., Bakin, A., Cunningham, P., Zain, M., O'Connell, D.O., and Ofengand, J. (1993). <i>Biochemistry</i> 32, 5539-5547.	94
95	16S	96080.1	534		0	INTERNAL	134698384	U to G	E. coli	562	1	Little effect on cell growth or translational fidelity. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). <i>Nucleic Acids Res.</i> 20, 4221-4227.	95
96	16S	96080.1	534		0	INTERNAL	134698384	U to C	E. coli	562	1	Little effect on cell growth or translational fidelity. b	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). <i>Nucleic Acids Res.</i> 20, 4221-4227.	96
97	16S	96080.1	534		0	INTERNAL	134698384	U to G	E. coli	562	1	Increased level of translational errors. b Double mutant (U534G/G517U).	O'Connor, M., Goring, H.U., and Dahlberg, A.E. (1992). <i>Nucleic Acids Res.</i> 20, 4221-4227.	97
98	16S	96080.1	538		513	HELIX	134694568	G to A	E. coli	562	1	(With U1192) Spcts recessive. b	Triman, K., Becker, E., Damm, C., Katz, J., Mori, H., Douthwaite, S., Yapjajak, C., Yoast, S., and Noller, H.F. (1989). <i>J. Mol. Biol.</i> 209, 645-653.	98
99	16S	96080.1	571	a	865	HELIX-KNOT	134694676	U to A	E. coli	562	1	Impaired structural stability and function of 30S subunit. b, c	Vila, A., Viril-Farley, J. and Tappich, W.E. (1994) <i>Proc. Natl. Acad. Sci.</i> 91, 11148-11152.	99
100	16S	96080.1	571	a	865	HELIX-KNOT	134694676	U to A	E. coli	562	1	Restores both structure and function to wild-type. b, c Double mutant (U571A/A865U)	Vila, A., Viril-Farley, J. and Tappich, W.E. (1994) <i>Proc. Natl. Acad. Sci.</i> 91, 11148-11152.	100
101	16S	96080.1	595		0	BULGE	134698564	A to U	E. coli	562	1	No effect on S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B. and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	101
102	16S	96080.1	595		0	BULGE	134698564	del A	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	102
103	16S	96080.1	597		643	HELIX	134694892	G to A	E. coli	562	1	Slightly decreased affinity for S8 binding. Double mutant (G597A/C643U).	Moine, H., Cachia, C., Westhof, E., Ehresmann, B., and Ehresmann, C. (1997). <i>RNA</i> 3,255-268.	103
104	16S	96080.1	597		643	HELIX	134694892	G to C	E. coli	562	1	Suppression of effects of 643G on S8 binding. c Double mutant (G597C/C643G).	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	104
105	16S	96080.1	597		643	HELIX	134694892	G597C/U641A/C643G	E. coli	562	1	No effect on S8 binding.	Moine, H., Cachia, C., Westhof, E., Ehresmann, B., and Ehresmann, C. (1997). <i>RNA</i> 3,255-268.	105
106	16S	96080.1	597		643	HELIX	134694892	G to U	E. coli	562	1	No binding of S8. Double mutant (G597U/C643G).	Moine, H., Cachia, C., Westhof, E., Ehresmann, B., and Ehresmann, C. (1997). <i>RNA</i> 3,255-268.	106
107	16S	96080.1	597		643	HELIX	134694892	G597U/U641A/C643G	E. coli	562	1	No binding of S8.	Moine, H., Cachia, C., Westhof, E., Ehresmann, B., and Ehresmann, C. (1997). <i>RNA</i> 3,255-268.	107

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
108	16S	96080.1	597		643	HELIX	134694892	G597U/U641C/C643G	E. coli	562	1	No effect on S8 binding.	Moine, H., Cachia, C., Westhof, E., Ehresmann, B., and Ehresmann, C. (1997). RNA 3,255-268.	108
109	16S	96080.1	598		640	HELIX	134694928	U to A	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	109
110	16S	96080.1	598		640	HELIX	134694928	U to A	E. coli	562	1	Partial restoration of S8 binding, with 5-fold reduced binding strength. c Double mutant (U598A/A640U).	Allmang, C., Mougel, M., Ehresmann, B., and Ehresmann, C. (1994) Nucleic Acids Research 22, 3708-3714.	110
111	16S	96080.1	642		0	BULGE	134698672	A to U	E. coli	562	1	Drastic reduction in S8 binding. c Double mutant (A642U/U598A).	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	111
112	16S	96080.1	642		0	BULGE	134698672	A to U	E. coli	562	1	Drastic reduction in S8 binding. c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B. and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	112
113	16S	96080.1	641		0	BULGE	134698672	U to C	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	113
114	16S	96080.1	641		0	BULGE	134698672	U to A	E. coli	562	1	No effect on S8 binding or cell growth. b,c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	114
115	16S	96080.1	640		598	HELIX	134694928	del A	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	115
116	16S	96080.1	640		598	HELIX	134694928	A to U	E. coli	562	1	Partial restoration of S8 binding, with 5-fold reduced binding strength. c Double mutant (A640U/U598A).	Allmang, C., Mougel, M., Ehresmann, B., and Ehresmann, C. (1994) Nucleic Acids Research 22, 3708-3714.	116
117	16S	96080.1	640		598	HELIX	134694928	A to U	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	117
118	16S	96080.1	639		599	HELIX	134694928	G to C	E. coli	562	1	No effect on S8 binding or cell growth. b,c Double mutant (G639C/C599G).	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	118

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
119	16S	96080.1	634		604	HELIX	134694928	C to U	E. coli	562	1	No effect on S8 binding or cell growth. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Gregory, R.J., Cahill, P.B.F., Thurlow, D.L., and Zimmerman, R.A. (1988). J. Mol. Biol. 204, 295-307.	119
120	16S	96080.1	631		0	INTERNAL	134698600	C to U	E. coli	562	1	No effect on S8 binding or cell growth. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Gregory, R.J., Cahill, P.B.F., Thurlow, D.L., and Zimmerman, R.A. (1988). J. Mol. Biol. 204, 295-307.	120
121	16S	96080.1	627		613	HELIX	134694964	G to A	E. coli	562	1	Reduced S8 binding; decreased growth rate. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Gregory, R.J., Cahill, P.B.F., Thurlow, D.L., and Zimmerman, R.A. (1988). J. Mol. Biol. 204, 295-307.	121
122	16S	96080.1	624		616	HELIX	134694964	C to U	E. coli	562	1	No effect on S8 binding or cell growth. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Gregory, R.J., Cahill, P.B.F., Thurlow, D.L., and Zimmerman, R.A. (1988). J. Mol. Biol. 204, 295-307.	122
123	16S	96080.1	618		0	HAIRPIN	134698636	C to U	E. coli	562	1	No effect on S8 binding or cell growth. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). Nucleic Acids Res. 14, 5741-5776. 2) Gregory, R.J., Cahill, P.B.F., Thurlow, D.L., and Zimmerman, R.A. (1988). J. Mol. Biol. 204, 295-307.	123
124	16S	96080.1	599		639	HELIX	134694928	C to G	E. coli	562	1	No effect on S8 binding or cell growth. b,c Double mutant (C599G/G639C).	Allmang, C., Mougel, M., Ehresmann, B., and Ehresmann, C. (1994) Nucleic Acids Research 22, 3708-3714.	124
125	16S	96080.1	599		639	HELIX	134694928	C to G	E. coli	562	1	Drastic reduction in S8 binding. c	Allmang, C., Mougel, M., Ehresmann, B., and Ehresmann, C. (1994) Nucleic Acids Research 22, 3708-3714.	125
126	16S	96080.1	598		640	HELIX	134694928	U to A	E. coli	562	1	Drastic reduction in S8 binding. c Double mutant (U598A/A642U).	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). Eur. J. Biochem. 215, 787-792.	126
127	16S	96080.1	15	a	0	FREE	134701120	G to A	E. coli	562	1	Moderate U23 suppressor.b	Dammel, C.S. and Noller, H.F. (1993). Genes and Development 7, 660-670.	127
128	16S	96080.1	13	a	21	HELIX	134693020	U to C	E. coli	562	1	No suppression of U13 effects.c Double mutant (U13C / A914G).	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	128
129	16S	96080.1	13	a	21	HELIX	134693020	U to A	E. coli	562	1	No suppression of U13 effects.c Double mutant (U13A / A914U).	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	129
130	16S	96080.1	13	a	21	HELIX	134693020	U to A	E. coli	562	1	Impaired growth. Double mutant (U13A / A914U).	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	130

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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131	16S	96080.1	13	a	21	HELIX	134693020	U to C	E. coli	562	1	Reduction of both streptomycin-induced misreading and streptomycin binding.c	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	131
132	16S	96080.1	13	a	21	HELIX	134693020	U to A	E. coli	562	1	Reduction of both streptomycin-induced misreading and streptomycin binding.c	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	132
133	16S	96080.1	13		21	HELIX	134693020	U to G	<i>Chlamydomonas reinhardtii</i>	3055	2	Intermediate level streptomycin resistance in <i>Chlamydomonas reinhardtii</i> chloroplast.	Harris, E.H., Burkhardt, B.D., Gilham, N.W. and Boynton, J.E. (1989) <i>Genetics</i> 123:281-292.	133
134	16S	96080.1	11		23	HELIX	134693020	G to A	E. coli	562	1	U23 suppressor. b	Dammel, C.S. and Noller, H.F. (1993). <i>Genes and Development</i> 7, 660-670.	134
135	16S	96080.1	642		0	BULGE	134698672	del A	E. coli	562	1	Reduced growth rate; drastic reduction in S8 binding. c	1) Gregory, R.J. and Zimmerman, R.A. (1986). <i>Nucleic Acids Res.</i> 14, 5741-5776. 2) Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B. and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	135
136	16S	96080.1	643		597	HELIX	134694892	C to G	E. coli	562	1	Drastic reduction in S8 binding. c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	136
137	16S	96080.1	643		597	HELIX	134694892	C to U	E. coli	562	1	Reduced S8 binding; decreased growth rate. b,c	1) Gregory, R.J. and Zimmerman, R.A. (1986). <i>Nucleic Acids Res.</i> 14, 5741-5776. 2) Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B. and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	137
138	16S	96080.1	643		597	HELIX	134694892	C to G	E. coli	562	1	Suppression of effects of 643G on S8 binding. c Double mutant (C643G/G597C).	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	138
139	16S	96080.1	645		594	HELIX	134694856	G to A	E. coli	562	1	No effect on S8 binding or cell growth. b,c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	139
140	16S	96080.1	651		588	HELIX	134694856	C to U	E. coli	562	1	No effect on S8 binding or cell growth. b,c	Mougel, M., Allmang, C., Eyermann, F., Cachia, C., Ehresmann, B., and Ehresmann, C. (1993). <i>Eur. J. Biochem.</i> 215, 787-792.	140
141	16S	96080.1	653		0	MULTISTEM	134700652	del U	<i>B. stearothermophilus</i>	1422	1	No effect on B. stearothermophilus S15 binding.	Batey, R.T., and Williamson, J.R. (1996). <i>J. Mol. Biol.</i> 261, 550-567.	141
142	16S	96080.1	665		0	INTERNAL	134698708	A to C	<i>B. stearothermophilus</i>	1422	1	No effect on B. stearothermophilus S15 binding. Double mutant (A665C/A668C).	Batey, R.T., and Williamson, J.R. (1996). <i>J. Mol. Biol.</i> 261, 550-567.	142

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
143	16S	96080.1	726		731	HELIX	134695252	C to G	E. coli	562	1	Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. c	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	143
144	16S	96080.1	726		731	HELIX	134695252	C to G	E. coli	562	1	Temperature-sensitive cell growth; decreased levels of S2 and S21 in 30S subunits; altered levels of normal proteins; novel proteins including heat-shock proteins. b	Prescott, C.D. and Dahlberg, A.E. (1990). EMBO J. 9, 289-294.	144
145	16S	96080.1	732		725	HELIX	134695252	C to U	E. coli	562	1	Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. c	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	145
146	16S	96080.1	740		666	HELIX	134695072	U to C	E. coli	562	1	Slight reduction in S15 binding.	Batey, R.T., and Williamson, J.R. (1996). J. Mol. Biol. 261, 550-567.	146
147	16S	96080.1	748		658	HELIX	134695000	del A	E. coli	562	1	30 fold reduction in S15 affinity.	Batey, R.T., and Williamson, J.R. (1996). J. Mol. Biol. 261, 550-567.	147
148	16S	96080.1	749		657	HELIX	134695000	C to A	E. coli	562	1	Little effect on S15 binding.	Batey, R.T., and Williamson, J.R. (1996). J. Mol. Biol. 261, 550-567.	148
149	16S	96080.1	752		0	MULTISTEM	134700652	G to C	E. coli	562	1	Severely reduced affinity for S15.	Batey, R.T., and Williamson, J.R. (1996). J. Mol. Biol. 261, 550-567.	149
150	23S	96092.1	754		743	HELIX	134726056	U to A	E. coli	562	1	Resistant to low concentrations of ketolide HMR3647; resistant to erythromycin b.	Xiong L, Shah S, Mauvais P, Mankin AS. 1999. A ketolide resistance mutation in domain II of 23S rRNA reveals the proximity of hairpin 35 to the peptidyl transferase center. Molecular Microbiology 31 (2): 633-639.	150
151	23S	96092.1	754		743	HELIX	134726056	U to A	E. coli	562	1	Confers macrolide and ketolide resistance.	Hansen L.H., Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domain II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	151
152	23S	96092.1	754		743	HELIX	134726056	U to A	Escherichia coli	562	1	Ery-LR, Tel-LR	Xiong, L., S. Shah, P. Mauvais, and A. S. Mankin. 1999. A ketolide resistance mutation in domain II of 23S rRNA reveals the proximity of hairpin 35 to the peptidyl transferase center. Mol. Microbiol. 31:633-639.	152
153	16S	96080.1	787		0	HAIRPIN	134699032	A to C	E. coli	562	1	Produces ribosomes that are highly functional.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	153
154	16S	96080.1	787		0	HAIRPIN	134699032	A to G	E. coli	562	1	Strongly inhibits ribosome function.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	154
155	16S	96080.1	787		0	HAIRPIN	134699032	A to U	E. coli	562	1	Moderately inhibits ribosome function.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	155

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
156	16S	96080.1	787		0	HAIRPIN	134699032	A to C	E. coli	562	1	Moderately inhibits ribosome function. Double mutant (A787C/C795A).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	156
157	16S	96080.1	787		0	HAIRPIN	134699032	A to C	E. coli	562	1	Strongly inhibits ribosome function. Double mutant (A787C/C795G).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	157
158	16S	96080.1	787		0	HAIRPIN	134699032	A to C	E. coli	562	1	Produces ribosomes that are highly functional. Double mutant (A787C/C795U).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	158
159	16S	96080.1	787		0	HAIRPIN	134699032	A to G	E. coli	562	1	Moderately inhibits ribosome function. Double mutant (A787G/C795A).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	159
160	16S	96080.1	787		0	HAIRPIN	134699032	A to G	E. coli	562	1	Moderately inhibits ribosome function. Double mutant (A787G/C795G).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	160
161	16S	96080.1	787		0	HAIRPIN	134699032	A to G	E. coli	562	1	Produces ribosomes that are highly functional. Double mutant (A787G/C795U).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	161
162	16S	96080.1	787		0	HAIRPIN	134699032	A to U	E. coli	562	1	Strongly inhibits ribosome function. Double mutant (A787U/C795A).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	162
163	16S	96080.1	787		0	HAIRPIN	134699032	A to U	E. coli	562	1	Strongly inhibits ribosome function. Double mutant (A787U/C795G).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	163
164	16S	96080.1	787		0	HAIRPIN	134699032	A to U	E. coli	562	1	Produces ribosome's that are highly functional. Double mutant (A787U/C795U).	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	164
165	16S	96080.1	791		0	HAIRPIN	134699032	G to A	E. coli	562	1	Slower growth rate than G791A alone. Double mutant (G1505U/G791A).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	165
166	16S	96080.1	792	a	0	HAIRPIN	134699032	G to A	E. coli	562	1	Reduced association between 30S and 50S subunits; decreased IF3 binding and protein synthesis. b,c	Tapprich, W.E., Goss, D.J., and Dahlberg, A.E. (1989). Proc. Natl. Acad. Sci. U.S.A. 86, 4927-2931.	166
167	16S	96080.1	792	a	0	HAIRPIN	134699032	A to G	E. coli	562	1	Reduced association between 30S and 50S subunits and reduced protein synthesis. [A792C associated with loss of IF3 binding]. b,c	Santer, M., Bennett-Guerrero, E., Byahatti, S., Czamecki, D., O'Connell, D., Meyer, M., Khoury, J., Cheng, X., Schwartz, I., and McLaughlin, J. (1990). Proc. Natl. Acad. Sci. U.S.A. 87, 3700-3704.	167
168	16S	96080.1	792	a	0	HAIRPIN	134699032	A to C	E. coli	562	1	Reduced association between 30S and 50S subunits and reduced protein synthesis. [A792C associated with loss of IF3 binding]. b,c	Santer, M., Bennett-Guerrero, E., Byahatti, S., Czamecki, D., O'Connell, D., Meyer, M., Khoury, J., Cheng, X., Schwartz, I., and McLaughlin, J. (1990). Proc. Natl. Acad. Sci. U.S.A. 87, 3700-3704.	168
169	16S	96080.1	792	a	0	HAIRPIN	134699032	A to U	E. coli	562	1	Reduced association between 30S and 50S subunits and reduced protein synthesis. [A792C associated with loss of IF3 binding]. b,c	Santer, M., Bennett-Guerrero, E., Byahatti, S., Czamecki, D., O'Connell, D., Meyer, M., Khoury, J., Cheng, X., Schwartz, I., and McLaughlin, J. (1990). Proc. Natl. Acad. Sci. U.S.A. 87, 3700-3704.	169
170	16S	96080.1	795		0	HAIRPIN	134699032	C to A	E. coli	562	1	Produces ribosomes that are highly functional.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	170

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
171	16S	96080.1	795		0	HAIRPIN	134699032	C to G	E. coli	562	1	Moderately inhibits ribosome function.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	171
172	16S	96080.1	795		0	HAIRPIN	134699032	C to U	E. coli	562	1	Produces ribosomes that are highly functional.	Lee, K., Varma, S., SantaLucia, J., and Cunningham, P.R. (1997). J. Mol. Biol. 269, 732-743.	172
173	16S	96080.1	814	a	0	MULTISTEM	134700616	A to C	E. coli	562	1	(With U1192) Growth rate and rate of protein synthesis decreased; recessive. b	McLaughlin, J., Reyes, B., Bennett-Guerrero, E., and Santer, M. (1988). J. Cell Biol. 107, 332a.	173
174	16S	96080.1	814	a	0	MULTISTEM	134700616	A to G	E. coli	562	1	(With U1192) Growth rate and rate of protein synthesis decreased; recessive. b	McLaughlin, J., Reyes, B., Bennett-Guerrero, E., and Santer, M. (1988). J. Cell Biol. 107, 332a.	174
175	16S	96080.1	814	a	0	MULTISTEM	134700616	A to U	E. coli	562	1	(With U1192) Growth rate and rate of protein synthesis decreased; recessive. b	McLaughlin, J., Reyes, B., Bennett-Guerrero, E., and Santer, M. (1988). J. Cell Biol. 107, 332a.	175
176	16S	96080.1	865	a	571	HELIX-KNOT	134694676	A to U	E. coli	562	1	Impaired structural stability and function of 30S subunit. b,c	Vila, A., Viril-Farley, J. and Tappich, W.E. (1994). Proc. Natl. Acad. Sci. 91,11148-11152.	176
177	16S	96080.1	865	a	571	HELIX-KNOT	134694676	A to U	E. coli	562	1	Restores both structure and function to wild-type. b,c Double mutant (A865U/U571A).	Vila, A., Viril-Farley, J. and Tappich, W.E. (1994). Proc. Natl. Acad. Sci. 91,11148-11152.	177
178	16S	96080.1	885		912	HELIX	134695504	G to A	N. plumbaginifolia	4092		Novel mutation for streptomycin resistance. Creates a Styl recognition sequence. Affects binding of S12. In N. plumbaginifolia.	Yeh, K.C., To, K.Y., Sun, S.W., Wu, M.C., Lin, T.Y., and Chen, C.C. (1994). Curr. Genet. 26, 132-135.	178
179	16S	96080.1	885	a	912	HELIX	134695504	G to C	E. coli	562	1	Interfere with 912*885 base pair and favored 912*888 conformation.	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	179
180	16S	96080.1	885	a	912	HELIX	134695504	G to U	E. coli	562	1	Favored the 912*885 conformation. Increases rates of readthrough errors and in-frame stop codons.	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	180
181	16S	96080.1	885	a	912	HELIX	134695504	G to C	E. coli	562	1	(With U1192) Lethal at high expression levels. b	Lodmell, J.S., Gutell, R.R. and Dahlberg, A.E. (1995). Proc. Natl. Acad. Sci., 92, 10555.	181
182	16S	96080.1	885	a	912	HELIX	134695504	G to C	E. coli	562	1	(With U1192) Restores normal growth and streptomycin sensitivity to G912 mutant. b Double mutant (G885C/C912G).	Lodmell, J.S., Gutell, R.R. and Dahlberg, A.E. (1995). Proc. Natl. Acad. Sci., 92, 10555.	182
183	16S	96080.1	885	a	912	HELIX	134695504	G to U	E. coli	562	1	(With U1192) Reduced growth rate; streptomycins. b Double mutant (G885U/C912G).	Lodmell, J.S., Gutell, R.R. and Dahlberg, A.E. (1995). Proc. Natl. Acad. Sci., 92, 10555.	183
184	16S	96080.1	888		0	INTERNAL	134699140	G to A	Yeast mitochondria	4932	3	Antisuppressor phenotype in Yeast. Increased base pairing in the 912*888 conformation.	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	184
185	16S	96080.1	888		0	INTERNAL	134699140	G to A	E. coli	562	1	Streptomycin. Double mutant (G888A/C912U).	Bonny, C., Montandon, P.-E., Marc-Martin, S., and Stutz, E. (1991). Biochimica et Biophysica Acta 1089, 213-219.	185
186	16S	96080.1	910		887	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*888 conformation, but without cold-sensitivity. Lowers stop codon read-through rates, and elevated rate of frame-shifting.	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	186
187	16S	96080.1	910		887	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*885 conformation. increases rates of readthrough errors and in-frame stop codons. Double mutant (C910G/G887C).	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	187
188	16S	96080.1	911		886	HELIX	134695504	U to C	E. coli	562	1	Favored the 912*885 conformation. increases rates of readthrough errors and in-frame stop codons.	Lodmell, J.S. and Dahlberg, A.E. (1997). Science. 277, 1262-1267.	188

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
189	16S	96080.1	912		885	HELIX	134695504	C to A	E. coli	562	1	No effect on cell growth. b	Frattali, A.L., Flynn, M.K., De Stasio, E.A., and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	189
190	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Decreased cell growth rate; low level streptomycin.	Frattali, A.L., Flynn, M.K., De Stasio, E.A., and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	190
191	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*888 conformation, but without cold-sensitivity. Lowers stop codon read-through rates, and elevated rate of frame-shifting.	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	191
192	16S	96080.1	912		885	HELIX	134695504	C to U	<i>N. plumbaginifolia</i>	4092		High-level streptomycin resistance in <i>N. plumbaginifolia</i> .	Yeh, K.C., To, K.Y., Sun, S.W., Wu, M.C., Lin, T.Y., and Chen, C.C. (1994). <i>Curr. Genet.</i> 26, 132-135.	192
193	16S	96080.1	912		885	HELIX	134695504	C to U	E. coli	562	1	Streptomycin. b	Montandon, P.E., Wagner, R., and Stutz, E. (1986). <i>EMBO J.</i> 5, 3705-3708.	193
194	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	(With U1192) Restores normal growth and streptomycin sensitivity to G912 mutant. b Double mutant (C912G/G885C).	Lodmell, J.S., Gutell, R.R. and Dahlberg, A.E. (1995) <i>Proc. Natl. Acad. Sci.</i> , 92, 10555.	194
195	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*885 conformation. Increases rates of readthrough errors and in-frame stop codons. Double mutant (C912G/G885C).	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	195
196	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*885 conformation. Increases rates of readthrough errors and in-frame stop codons. Double mutant (C912G/G885C).	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	196
197	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	(With U1192) Reduced growth rate; streptomycins. b Double mutant (C912G/G885U).	Lodmell, J.S., Gutell, R.R. and Dahlberg, A.E. (1995) <i>Proc. Natl. Acad. Sci.</i> , 92, 10555.	197
198	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Allowed base pairing at 912*885 but interfered with 912*888 base pairing. Double mutant (C912G/G885U).	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	198
199	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Favored the 912*888 conformation and cold sensitivity, but does not increase reactivity to kethoxal. Double mutant (C912G/G888C).	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	199
200	16S	96080.1	912		885	HELIX	134695504	C to G	E. coli	562	1	Favored 912*888 conformation but cold-sensitive. Double mutant (C912G/G888U).	Lodmell, J.S. and Dahlberg, A.E. (1997). <i>Science</i> . 277, 1262-1267.	200
201	16S	96080.1	912		885	HELIX	134695504	C to U	E. coli	562	1	Streptomycin. Double mutant (C912U/G888A).	Bonny, C., Montandon, P.-E., Marc-Martin, S., and Stutz, E. (1991). <i>Biochimica et Biophysica Acta</i> 1089, 213-219.	201
202	16S	96080.1	912		885	HELIX	134695504	U to C	<i>S. cerevisiae</i>	4932		Decreases resistance to streptomycin and increases resistance to paromomycin and inhibits nonsense suppression induced by paromomycin in <i>S. cerevisiae</i> .	Chernoff, U.O., Vincent, A., and Liebman, A.W. (1994). <i>Embo J.</i> 13, 96-913.	202
203	16S	96080.1	912		885	HELIX	134695504	del C	E. coli	562	1	Dominant lethal. b	Frattali, A.L., Flynn, M.K., De Stasio, E.A., and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	203
204	16S	96080.1	913		0	MULTISTEM	134701048	A to G	E. coli	562	1	Binding of streptomycin decreased; both streptomycin-induced misreading and streptomycin-induced inhibition of protein synthesis decreased. c	Leclerc, D., Melancon, P., and Brakier-Gingras (1991a). <i>Nucleic Acids Res.</i> 19, 3973-3977.	204

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
205	16S	96080.1	913		0	MULTISTEM	134701048	A to G	<i>N. plumbaginifolia</i>	4092		Moderate effect of streptomycin binding in <i>N. plumbaginifolia</i> .	Yeh, K.C., To, K.Y., Sun, S.W., Wu, M.C., Lin, T.Y., and Chen, C.C. (1994). <i>Curr. Genet.</i> 26, 132-135.	205
206	16S	96080.1	914		0	MULTISTEM	134701048	A to C	<i>Chlamydomonas reinhardtii</i>	3055	2	High level streptomycin resistance in chloroplast of <i>Chlamydomonas reinhardtii</i>	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) <i>Genetics</i> 123:281-292.	206
207	16S	96080.1	914	a	0	MULTISTEM	134701048	A to C	<i>E. coli</i>	562	1	Streptomycin.	Bonny, C., Montandon, P.-E., Marc-Martin, S., and Stutz, E. (1991). <i>Biochimica et Biophysica Acta</i> 1089, 213-219.	207
208	16S	96080.1	914	a	0	MULTISTEM	134701048	A to U	<i>E. coli</i>	562	1	Impaired growth.	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). <i>FEBS Letters</i> 401, 175-179.	208
209	16S	96080.1	914	a	0	MULTISTEM	134701048	A to G	<i>E. coli</i>	562	1	No suppression of U13 effects. c Double mutant (A914G/U13A).	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	209
210	16S	96080.1	914	a	0	MULTISTEM	134701048	A to U	<i>E. coli</i>	562	1	No suppression of U13 effects. c Double mutant (A914U/U13C).	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	210
211	16S	96080.1	914	a	0	MULTISTEM	134701048	A to G	<i>E. coli</i>	562	1	Reduction of both streptomycin-induced misreading and streptomycin binding. c	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	211
212	16S	96080.1	914	a	0	MULTISTEM	134701048	A to U	<i>E. coli</i>	562	1	Reduction of both streptomycin-induced misreading and streptomycin binding. c	Pinard, R., Payant, C., Melancon, P., and Brakier-Gingras, L. (1993). <i>FASEB J.</i> 7, 173-176.	212
213	16S	96080.1	915		0	MULTISTEM	134701048	A to G	<i>N. plumbaginifolia</i>	4092		Increased streptomycin binding in <i>N. plumbaginifolia</i> .	Yeh, K.C., To, K.Y., Sun, S.W., Wu, M.C., Lin, T.Y., and Chen, C.C. (1994). <i>Curr. Genet.</i> 26, 132-135.	213
214	16S	96080.1	915		0	MULTISTEM	134701048	A to G	<i>Chlamydomonas reinhardtii</i>	3055	2	Intermediate level streptomycin resistance in chloroplast of <i>Chlamydomonas reinhardtii</i>	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) <i>Genetics</i> 123:281-292.	214
215	16S	96080.1	915	a	0	MULTISTEM	134701048	A to G	<i>E. coli</i>	562	1	Binding of streptomycin decreased; both streptomycin-induced misreading and streptomycin-induced inhibition of protein synthesis decreased. c	Leclerc, D., Melancon, P., and Brakier-Gingras (1991a). <i>Nucleic Acids Res.</i> 19, 3973-3977.	215
216	16S	96080.1	916		19	HELIX-KNOT	134693056	U to G	<i>E. coli</i>	562	1	20% decrease in translation efficiency. b	Poot R.A., van den Worm S.H.E, leij C.W.A, van Djuin J. 1998. Base complementarity in helix 2 of the central psuedoknot in 16S rRNA is essential for ribosome functioning. <i>Nucleic Acids Research</i> 26 (2): 549-553.	216
217	16S	96080.1	917		18	HELIX-KNOT	134693056	G to A	<i>E. coli</i>	562	1	Translational activity restored. b Double mutant (G917A/C18U).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	217

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
218	16S	96080.1	917		18	HELIX-KNOT	134693056	G to C	E. coli	562	1	Translational activity restored. b Double mutant (G917C/C18G).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	218
219	16S	96080.1	917		18	HELIX-KNOT	134693056	G to U	E. coli	562	1	Translational activity restored. b Double mutant (G917U/C18A).	Brink, M.F., Verbeet, M. Ph., and deBoer, H.A. (1993b). The Translational Apparatus: Structure, Function, Regulation and Evolution. pp. 371-374. Plenum Press, New York.	219
220	16S	96080.1	918		17	HELIX-KNOT	134693056	A to G	E. coli	562	1	Increased stability of helix 2; 30% decrease in activity. b	Poot R.A., van den Worm S.H.E, leij C.W.A, van Djuin J. 1998. Base complementarity in helix 2 of the central psuedoknot in 16S rRNA is essential for ribosome functioning. Nucleic Acids Research 26 (2): 549-553.	220
221	16S	96080.1	920	a	0	FREE	134701156	del U	E. coli	562	1	Severe reduction in rRNA binding.	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	221
222	16S	96080.1	921	a	1396	HELIX	134695576	U to G	E. coli	562	1	Severe reduction in tRNA binding. c Double mutant (U921G/G922U).	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	222
223	16S	96080.1	922	a	1395	HELIX	134695576	G to U	E. coli	562	1	Severe reduction in tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	223
224	16S	96080.1	922	a	1395	HELIX	134695576	G to U	E. coli	562	1	Severe reduction in tRNA binding. c Double mutant (G922U/U912G).	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	224
225	16S	96080.1	926	a	0	BULGE	134699212	del G	E. coli	562	1	Moderate reduction in tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	225
226	16S	96080.1	966		0	HAIRPIN	134699284	G to A	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	226
227	16S	96080.1	966		0	HAIRPIN	134699284	G to C	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	227
228	16S	96080.1	966		0	HAIRPIN	134699284	G to U	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	228
229	16S	96080.1	967		0	HAIRPIN	134699284	C to G	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	229
230	16S	96080.1	967		0	HAIRPIN	134699284	C to U	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	230
231	16S	96080.1	967		0	HAIRPIN	134699284	C to A	E. coli	562	1	No effect on cell growth rate. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	231
232	16S	96080.1	967		0	HAIRPIN	134699284	del C	E. coli	562	1	Dominant lethal. b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	232

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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233	16S	96080.1	980		0	MULTISTEM	134700832	C to A	E. coli	562	1	(With U1192) A 980 has only a small effect on growth; G980 decreases growth rate dramatically in the presence of Spc.	Santer, U.V., Dahlberg, A.E., and Santer, M. (1991). J. Cell Biol. 115, 72a.	233
234	16S	96080.1	980		0	MULTISTEM	134700832	C to G	E. coli	562	1	(With U1192) A 980 has only a small effect on growth; G980 decreases growth rate dramatically in the presence of Spc.	Santer, U.V., Dahlberg, A.E., and Santer, M. (1991). J. Cell Biol. 115, 72a.	234
235	16S	96080.1	981	a	0	MULTISTEM	134700832	U to G	E. coli	562	1	Lethal under natural promoter; partially excluded from polysomes. b	Santer, U.V., Wineburg, S., Giza, E., D'Amco, R., Bromley, S., Santer, M. (1995b). Abstract 54. Frontiers in Translation, in press.	235
236	16S	96080.1	981	a	0	MULTISTEM	134700832	U to A	E. coli	562	1	Lethal under natural promoter; partially excluded from polysomes. b	Santer, U.V., Wineburg, S., Giza, E., D'Amco, R., Bromley, S., Santer, M. (1995b). Abstract 54. Frontiers in Translation, in press.	236
237	16S	96080.1	981	a	0	MULTISTEM	134700832	U to C	E. coli	562	1	(With U1192) Recessive lethal; Spcs. b	Santer, U.V., Wineburg, S., Giza, E., D'Amco, R., Bromley, S., Santer, M. (1995b). Abstract 54. Frontiers in Translation, in press.	237
238	23S	96092.1	1005		1138	HELIX-KNOT	134726776	C to G	E. coli	562	1	Restores normal growth under pL promoter; (with 2058G and erythromycin) Erys. a Double mutant(C1005G/G1138C).	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	238
239	23S	96092.1	1005		1138	HELIX-KNOT	134726776	C to G	E. coli	562	1	Slow growth under natural promoter; (with 2058G and erythromycin) severe growth retardation. a	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	239
240	23S	96092.1	1005		1138	HELIX-KNOT	134726776	C to G	E. coli	562	1	Slow growth under pL promoter; (with 2058G and erythromycin) Erys. a Double mutant (C1005G/C1006U)	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	240
241	23S	96092.1	1006		1137	HELIX-KNOT	134726776	C to U	E. coli	562	1	Slow growth under pL promoter; (with 2058G and erythromycin) Erys. a Double mutant (C1005G/C1006U)	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	241
242	23S	96092.1	1006		1137	HELIX-KNOT	134726776	C to U	E. coli	562	1	Lethal under natural promoter; under pL promoter; (with 2058G and erythromycin) Erys. a	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	242
243	23S	96092.1	1006		1137	HELIX-KNOT	134726776	C to U	E. coli	562	1	Restores normal growth under pL promoter; (with 2058G and erythromycin)Erys. a Double mutant (C1006U/G1137A)	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	243

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244	16S	96080.1	1054		0	BULGE	134699464	C to A	E. coli	562	1	Defective in the catalysis of peptidyl-tRNA hydrolysis in the presence of RF2. c	Arkov A.L., Freistoffer D.V., Ehrenberg M, Murgola E.J. 1998. Mutations in RNAs of both ribosomal subunits cause defects in translation termination. The EMBO Journal 17 (5): 1507-1514.	244
245	16S	96080.1	1054	a	0	BULGE	134699464	C to A	E. coli	562	1	Lethal above 37 [ring] or high expression. UGA suppression.	Pagel, F.T., Zhao, S.Q., Hijazi, K.A., and Murgola, E.J. (1997). J. Mol. Biol. 267, 1113-1123.	245
246	16S	96080.1	1054	a	0	BULGE	134699464	C to A	E. coli	562	1	Nonsense suppressors. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). Biochem. Cell Biol. 73, 925-931.	246
247	16S	96080.1	1054	a	0	BULGE	134699464	C to A	E. coli	562	1	Only C1054G resulted in significant reduction of both cellular growth rate and ability of ribosomes to stop specifically at UGA. b	Hanfler, A., Kleuvers, B., and Goring, H.U. (1990). Nucleic Acids Res. 18, 5625-5632.	247
248	16S	96080.1	1054	a	0	BULGE	134699464	C to G	E. coli	562	1	Slight defect in subunit association. Suppresses all three termination codons.	Pagel, F.T., Zhao, S.Q., Hijazi, K.A., and Murgola, E.J. (1997). J. Mol. Biol. 267, 1113-1123.	248
249	16S	96080.1	1054	a	0	BULGE	134699464	C to U	E. coli	562	1	Temperature sensitive lethality; slow growth rate at 37 [ring]C and when highly expressed. Defective ability to enter polysome.	Pagel, F.T., Zhao, S.Q., Hijazi, K.A., and Murgola, E.J. (1997). J. Mol. Biol. 267, 1113-1123.	249
250	16S	96080.1	1054	a	0	BULGE	134699464	del C	E. coli	562	1	No effect on translational fidelity. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). Biochem. Cell Biol. 73, 925-931.	250
251	16S	96080.1	1054	a	0	BULGE	134699464	del C	E. coli	562	1	Lethal at 31 [ring], No suppression of trpA nonsense mutation. Affects 30S subunit assembly and subunit association.	Pagel, F.T., Zhao, S.Q., Hijazi, K.A., and Murgola, E.J. (1997). J. Mol. Biol. 267, 1113-1123.	251
252	16S	96080.1	1054	a	0	BULGE	134699464	del C	E. coli	562	1	UGA suppression. b	Murgola, E.J., Hijazi, K.A., Goring, H.U., and Dahlberg, A.E. (1988). Proc. Natl. Acad. Sci. U.S.A. 85, 4162-4165.	252
253	16S	96080.1	1054	a	0	BULGE	134699464	C to G	E. coli	562	1	Nonsense suppressors. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). Biochem. Cell Biol. 73, 925-931.	253
254	16S	96080.1	1054	a	0	BULGE	134699464	C to G	E. coli	562	1	Only C1054G resulted in significant reduction of both cellular growth rate and ability of ribosomes to stop specifically at UGA. b	Hanfler, A., Kleuvers, B., and Goring, H.U. (1990). Nucleic Acids Res. 18, 5625-5632.	254
255	16S	96080.1	1054	a	0	BULGE	134699464	C to U	E. coli	562	1	Only C1054G resulted in significant reduction of both cellular growth rate and ability of ribosomes to stop specifically at UGA. b	Hanfler, A., Kleuvers, B., and Goring, H.U. (1990). Nucleic Acids Res. 18, 5625-5632.	255
256	23S	96092.1	1056		0	MULTISTEM	134737900	G1056A/U1028C/A1086G	E. coli	562	1	Decreases stability of tertiary structure. b	Draper D. E. 1998. Protein-RNA Recognition in a Highly Conserved Ribosomal Domain Targeted by Thiazole Antibiotics. The Many Faces of RNA. 113-125.	256
257	23S	96092.1	1056		0	MULTISTEM	134737900	G to A	E. coli	562	1	Binding of both L11 and thioestrapton is weakened in RNA fragments. b	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	257

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258	23S	96092.1	1056		0	MULTISTEM	134737900	G to A	E. coli	562	1	Stoichiometric L11 binding. b (with 2058G and erythromycin) Reduced growth rate. a	1) Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731. 2) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	258
259	23S	96092.1	1056		0	MULTISTEM	134737900	G to C	E. coli	562	1	Binding of thiostrepton is weakened in RNA fragments. b	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	259
260	16S	96080.1	1057	a	1203	HELIX	134696116	G to C	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (G1057C/G1058U).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	260
261	16S	96080.1	1058	a	1199	HELIX	134696152	G to U	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (G1058U/G1057C)	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	261
262	16S	96080.1	1058		1199	HELIX	134696152	G to C	E. coli	562	1	Causes more resistance to tetracycline in gram-positive bacteria.	Ross J.I., Eady E.A., Cove J.H., Cunliffe W.J. 1998. 16S rRNA Mutation Associated with Tetracycline Resistance in a Gram-Positive Bacterium. Antimicrobial Agents and Chemotherapy 42 (7): 1702-1705.	262
263	23S	96092.1	1061		0	INTERNAL	134733868	U to G	E. coli	562	1	Restores tertiary structure b.	Draper D.E. 1998. Protein-RNA recognition in a highly conserved ribosomal domain targeted by thiazole antibiotics. The many faces of RNA. 113-125.	263
264	23S	96092.1	1061		0	INTERNAL	134733868	U to A	E. coli	562	1	Increases stability of tertiary structure; increase temperature at which secondary structure unfolds b.	Draper D.E. 1998. Protein-RNA recognition in a highly conserved ribosomal domain targeted by thiazole antibiotics. The many faces of RNA. 113-125.	264
265	23S	96092.1	1062		1076	HELIX	134727028	G to A	E. coli	562	1	Much reduced L11 binding. b (with 2058G and erythromycin)	1) Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731. 2) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	265
266	16S	96080.1	1064		1192	HELIX	134696188	G to A	Nicotiana	4085	2	High level spectinomycin resistance in Nicotiana chloroplast.	Fromm, H., Edelman, M., Aviv, D. and Galun, E. (1987). EMBO J. 6, 3233-3237.	266
267	16S	96080.1	1064		1192	HELIX	134696188	G to A	E. coli	562	1	Spcr.b,c	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	267
268	16S	96080.1	1064		1192	HELIX	134696188	G to A	E. coli	562	1	Spcr.b,c Double mutant (G1064A/C1192U).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	268
269	16S	96080.1	1064		1192	HELIX	134696188	G to C	E. coli	562	1	Spcr; 5-fold lower translational activity. b,c Double mutant (G1064C/C1192G).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	269
270	16S	96080.1	1064		1192	HELIX	134696188	G to U	E. coli	562	1	Spcr.b,c Double mutant (G1064U/C1192A).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	270

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271	23S	96092.1	1064		1074	HELIX	134727028	C to U	E. coli	562	1	Stoichiometric L11 binding. b (with 2058G and erythromycin) Reduced growth rate. a	1) Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731. 2) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	271
272	23S	96092.1	1064		1074	HELIX	134727028	C to U	E. coli	562	1	Normal in vivo assembly of L11 into ribosomes. a Double mutant (C1064U/C1075U).	1) Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731. 2) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	272
273	16S	96080.1	1064		1192	HELIX	134696188	G to U	E. coli	562	1	Spcr.b,c Double mutant (C1192A/G1064U).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	273
274	16S	96080.1	1064		1192	HELIX	134696188	G to C	E. coli	562	1	Spcr; 5-fold lower translational activity. b,c Double mutant (C1192G/G1064C).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	274
275	16S	96080.1	1064		1192	HELIX	134696188	G to A	E. coli	562	1	Spcr.b,c Double mutant (C1192U/G1064A).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	275
276	16S	96080.1	1064		1192	HELIX	134696188	G to C	E. coli	562	1	Spcr.b,c	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	276
277	16S	96080.1	1064		1192	HELIX	134696188	G to U	E. coli	562	1	Spcr.b,c	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	277
278	23S	96092.1	1065		0	HAIRPIN	134733904	U1065A/A1073C	E. coli	562	1	Dramatic effect on RNA folding in context of (CG)C triple b.	Conn G.L., Gutell R.R., Draper D.E. 1998. A functional ribosomal RNA tertiary structure involves a base triple interaction. Biochemistry 37: 11980-11988.	278
279	16S	96080.1	1065		0	MULTISTEM	134700940	U to C	E. coli	562	1	Inhibits translation, increased level of acetylation, and does not allow S5 to bind. Causes an accumulation of free 30S subunits. Double mutant (U1065C/A1191G).	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486.	279
280	16S	96080.1	1066		0	MULTISTEM	134700940	C to U	E. coli	562	1	Spcr; increased sensitivity to fusidic acid. b Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. c	Johanson, U. and Hughes, D. (1995) Nucleic Acids Res. 23, 464-466.	280
281	23S	96092.1	1067		0	HAIRPIN	134733904	A to U	E. coli	562	1	Normal growth	1) Spahn, C., Remme, J., Schafer, M. and Nierhaus, K. (1996). J. Biol. Chem. 271: 32849-32856. 2) Spahn, C., Remme, J., Schafer, M. and Nierhaus, K. (1996). J. Biol. Chem. 271: 32857-32862.	281
282	23S	96092.1	1067		0	HAIRPIN	134733904	A to G	E. coli	562	1	Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. b	Brown, S. (1989) J. Mol. Biol. 209, 79-90.	282
283	23S	96092.1	1067		0	HAIRPIN	134733904	A to G	Halobacterium	2243	1	Thiostrepton resistance in Halobacterium sp.	Hummel, H., and A. BÄ¶ck. (1987) Biochimie 69:857-861.	283
284	23S	96092.1	1067		0	HAIRPIN	134733904	A to U	Halobacterium	2243	1	Thiostrepton resistance in Halobacterium sp.	Hummel, H., and A. BÄ¶ck. (1987) Biochimie 69:857-861.	284

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
285	23S	96092.1	1067		0	HAIRPIN	134733904	A to U	E. coli	562	1	Increased readthrough at UAG. Suppressed by combination with G2538A, C or U.	Saarma, U., Lewicki, B.T.U., Margus, T., Nigul, S. and Remme, J. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 163	285
286	23S	96092.1	1067		0	HAIRPIN	134733904	A to U	E. coli	562	1	A to C or U confers high level resistance to thiostrepton, whereas A to G confers intermediate level resistance; drug binding affinity is reduced similarly. a, b Expression by host RNA polymerase results in formation of active ribosomal subunits in vivo.	1) Thompson, J. and Cundliffe, E. (1991) Biochimie 73: 1131-1135. 2) Thompson, J., Cundliffe, E. and Dahlberg, A.E. (1988) J. Mol. Biol. 203: 457-465. 3) Lewicki, B.T.U., Margus, T., Remme, J. and Nierhaus, K.H. (1993) J. Mol. Biol. 231, 581-593. 4) LAST	286
287	23S	96092.1	1067		0	HAIRPIN	134733904	A to C	E. coli	562	1	A to C or U confers high level resistance to thiostrepton, whereas A to G confers intermediate level resistance; drug binding affinity is reduced similarly. a, b Expression by host RNA polymerase results in formation of active ribosomal subunits in vivo.	1) Thompson, J. and Cundliffe, E. (1991) Biochimie 73: 1131-1135. 2) Thompson, J., Cundliffe, E. and Dahlberg, A.E. (1988) J. Mol. Biol. 203: 457-465. 3) Lewicki, B.T.U., Margus, T., Remme, J. and Nierhaus, K.H. (1993) J. Mol. Biol. 231, 581-593. 4) LAST	287
288	23S	96092.1	1067		0	HAIRPIN	134733904	A to G	E. coli	562	1	A to C or U confers high level resistance to thiostrepton, whereas A to G confers intermediate level resistance; drug binding affinity is reduced similarly. a, b Expression by host RNA polymerase results in formation of active ribosomal subunits in vivo.	1) Thompson, J. and Cundliffe, E. (1991) Biochimie 73: 1131-1135. 2) Thompson, J., Cundliffe, E. and Dahlberg, A.E. (1988) J. Mol. Biol. 203: 457-465. 3) Lewicki, B.T.U., Margus, T., Remme, J. and Nierhaus, K.H. (1993) J. Mol. Biol. 231, 581-593. 4) LAST	288
289	23S	96092.1	1067		0	HAIRPIN	134733904	A to U	E. coli	562	1	Constituted 30% of the total 23S rRNA pool in the ribosomes; exhibited 30% thiostrepton resistance in poly (U) translation b.	Liiv A, Remme J. 1998. Base-pairing of 23S rRNA ends is essential for ribosomal large subunit assembly. J. Mol. Biol. 285: 965-975.	289
290	23S	96092.1	1068		0	HAIRPIN	134733904	G to A	E. coli	562	1	Reduced L11 binding. b (with 2058G) Lethal when expressed from rrnB or pL promoter in presence of erythromycin. a	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731.	290
291	23S	96092.1	1068		0	HAIRPIN	134733904	G to A	E. coli	562	1	Suppression of 1068A; lethality only in absence of erythromycin. a Double mutant (G1068A/G1099A)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	291
292	23S	96092.1	1071		0	HAIRPIN	134733904	G to A	E. coli	562	1	Suppression of temperature sensitivity of 1071A.a; reduced L11 binding.b	1)Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2)Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In K.H.Nierhaus, F.Franceschi, A.R Subramania, Erdmann, V.A and B.Wittmann Liebold (ed.) The Translation Appara	292

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
293	23S	96092.1	1071		0	HAIRPIN	134733904	G to A	E. coli	562	1	Suppression of temperature sensitivity of 1071A. a Double mutant (G1071A/G1106A)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	293
294	23S	96092.1	1072		0	HAIRPIN	134733904	C to U	E. coli	562	1	Lethal when expressed from rrnB or pL promoter in presence of erythromycin. a	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	294
295	23S	96092.1	1072		0	HAIRPIN	134733904	C to U	E. coli	562	1	Tertiary structure of the RNA is eliminated; binding of L11 and thiostrepton are reduced by 10 fold b.	Conn G.L., Gutell R.R., Draper D.E. 1998. A functional ribosomal RNA tertiary structure involves a base triple interaction. Biochemistry 37: 11980-11988.	295
296	23S	96092.1	1075		1063	HELIX	134727028	C to U	E. coli	562	1	No effect on L11 binding. b	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	296
297	23S	96092.1	1075		1063	HELIX	134727028	C to U	E. coli	562	1	Normal in vivo assembly of L11 into ribosomes. a Double mutant (C1075U/C1064U)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	297
298	23S	96092.1	1075		1063	HELIX	134727028	C to U	E. coli	562	1	Normal in vivo assembly of L11 into ribosomes. a Double mutant (C1064U/C1075U).	1) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In K.H.Nierhaus, F.Franceschi, A.R Subramania, Erdmann, V.A and B.Wittmann Liebold (ed.) The Translation Apparatus: Structure, Function, Regulation and Evolution. Plenum Press, New York,	298
299	23S	96092.1	1076		1062	HELIX	134727028	C to U	E. coli	562	1	No effect on L11 binding. b	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	299
300	23S	96092.1	1079		1059	HELIX	134726992	C to U	E. coli	562	1	No effect on L11 binding. b	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	300
301	23S	96092.1	1082		1086	HELIX	134727064	U to C	E. coli	562	1	Binding of both L11 and thiostrepton is weakened in RNA fragments. b	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	301
302	23S	96092.1	1082		1086	HELIX	134727064	U to A	E. coli	562	1	Both L11 and thiostrepton bind RNA fragments with about wild-type affinity. b Double mutant(U1082A/A1086U)	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	302
303	23S	96092.1	1082		1086	HELIX	134727064	U to C	E. coli	562	1	Both L11 and thiostrepton bind RNA fragments with about wild-type affinity. b Double mutant(U1082C/A1086G)	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	303
304	23S	96092.1	1084		0	HAIRPIN	134733940	A to U	E. coli	562	1	Destabilizes the tertiary structure b.	Draper DE. 1998. Protein-RNA Recognition in a Highly Conserved Ribosomal Domain Targeted by Thiazole Antibiotics. The Many Faces of RNA. 113-125.	304
305	23S	96092.1	1085		0	HAIRPIN	134733940	A to G	E. coli	562	1	Reduced L11 binding. b	Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. Pl	305

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
306	23S	96092.1	1085		0	HAIRPIN	134733940	A to C	E. coli	562	1	Reduced L11 binding. b	Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. Pl	306
307	23S	96092.1	1085		0	HAIRPIN	134733940	A to U	E. coli	562	1	Reduced L11 binding. b	Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. Pl	307
308	23S	96092.1	1086		1082	HELIX	134727064	A to G	E. coli	562	1	Both L11 and thiostrepton fragments with about wild-type affinity.b Double mutant (A1086U/U1082A)	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	308
309	23S	96092.1	1086		1082	HELIX	134727064	A to G	E. coli	562	1	Both L11 and thiostrepton fragments with about wild-type affinity. b Double mutant (A1086G/U1082C)	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	309
310	23S	96092.1	1086		1082	HELIX	134727064	A to G	E. coli	562	1	Binding of both L11 and thiostrepto is weakened in RNA fragments. b	Ryan, P.C. and Draper, D.E. (1991) Proc. Natl. Acad. Sci. USA 88, 6308-6312.	310
311	23S	96092.1	1087		1102	HELIX	134727100	G to A	E. coli	562	1	Reduced L11 binding. b	Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. Pl	311
312	23S	96092.1	1091		1100	HELIX	134727136	G to A	E. coli	562	1	Reduced L11 binding. b	Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H. Nierhaus, F. Franceschi, A.R. Subramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp.	312
313	23S	96092.1	1092		1099	HELIX	134727136	C to U	E. coli	562	1	(With 2058G) Temperature sensitivity. a	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	313
314	23S	96092.1	1092		1099	HELIX	134727136	C to U	E. coli	562	1	Partial suppression of 1092U temperature sensitivity. a Double mutant (C1092U/C1109U)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	314
315	23S	96092.1	1092		1099	HELIX	134727136	C to U	E. coli	562	1	Suppression of 1092U temperature sensitivity. a Double mutant (C1092U/G1099A)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	315

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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316	23S	96092.1	1092		1099	HELIX	134727136	C1092U/G1099A	E. coli	562	1	Dramatically alters the pH dependence of tertiary folding. b	Conn GL, Gutell RR, Draper DE. 1998. A Functional Ribosomal RNA Tertiary Structure Involves a Base Triple Interaction. <i>Biochemistry</i> 37: 11980-11988.	316
317	23S	96092.1	1092		1099	HELIX	134727136	C1092G/G1099A/C1072U	E. coli	562	1	Restores the tertiary structure of the RNA; shows significant sensitivity of solution pH. b	Conn GL, Gutell RR, Draper DE. 1998. A Functional Ribosomal RNA Tertiary Structure Involves a Base Triple Interaction. <i>Biochemistry</i> 37: 11980-11988.	317
318	23S	96092.1	1092		1099	HELIX	134727136	C1092G/G1099C	E. coli	562	1	Unusual melting profile and no clear tertiary structure transition at higher pH in the context of both (CG)C and (GC)U RNAs. b	Conn GL, Gutell RR, Draper DE. 1998. A Functional Ribosomal RNA Tertiary Structure Involves a Base Triple Interaction. <i>Biochemistry</i> 37: 11980-11988.	318
319	23S	96092.1	1093		0	HAIRPIN	134734012	G to A	E. coli	562	1	Defective in the catalysis of peptidyl-tRNA hydrolysis in the presence of RF2. c	Arkov AL, Freistroffer DV, Ehrenberg M, Murgola E.J. 1998. Mutations in RNAs of both ribosomal subunits cause defects in translation termination. <i>The EMBO Journal</i> 17(5): 1507-1514.	319
320	23S	96092.1	1093		0	HAIRPIN	134734012	del G	E. coli	562	1	Reduced L11 binding; trpA UGA suppressor; temperature sensitive.	1) Douthwaite et al., <i>FIX</i> 1993; 2) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) <i>Proc. Natl. Acad. Sci. USA</i> . 92, 12309-12313. 3) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) <i>Biochem. Cell Biology</i> , 73, 925-931.	320
321	23S	96092.1	1093		0	HAIRPIN	134734012	G to A	E. coli	562	1	Reduced L11 binding; trpA UGA suppressor; temperature sensitive.	1) Douthwaite et al., <i>FIX</i> 1993; 2) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) <i>Proc. Natl. Acad. Sci. USA</i> . 92, 12309-12313. 3) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) <i>Biochem. Cell Biology</i> , 73, 925-931.	321
322	23S	96092.1	1093		0	HAIRPIN	134734012	G to A	E. coli	562	1	trpA UGA suppressor; temperature sensitive	Xu, W. and Murgola, E.J. (1996). <i>J. Mol. Biol.</i> 264: 407-411.	322
323	23S	96092.1	1093		0	HAIRPIN	134734012	G to C	E. coli	562	1	trpA UGA suppressor; temperature sensitive	Xu, W. and Murgola, E.J. (1996). <i>J. Mol. Biol.</i> 264: 407-411.	323
324	23S	96092.1	1093		0	HAIRPIN	134734012	G to U	E. coli	562	1	trpA UGA suppressor; temperature sensitive	Xu, W. and Murgola, E.J. (1996). <i>J. Mol. Biol.</i> 264: 407-411.	324
325	23S	96092.1	1093		0	HAIRPIN	134734012	G to A	E. coli	562	1	trpA UGA suppressor; temperature sensitive Double mutant(G1093A/A1098G)	Xu, W. and Murgola, E.J. (1996). <i>J. Mol. Biol.</i> 264: 407-411.	325
326	23S	96092.1	1094		0	HAIRPIN	134734012	U to A	E. coli	562	1	Reduced L11 binding; trpA UGA suppressor; temperature sensitive.	1) Douthwaite et al., <i>FIX</i> 1993; 2) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) <i>Proc. Natl. Acad. Sci. USA</i> . 92, 12309-12313. 3) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) <i>Biochem. Cell Biology</i> , 73, 925-931.	326

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327	23S	96092.1	1095		0	HAIRPIN	134734012	A to U	E. coli	562	1	Reduced thiostrepton and micrococcin binding.	Rosendahl, G. and Douthwaite, S. (1994) Nucleic Acids Res. 22, 357-363.	327
328	23S	96092.1	1095		0	HAIRPIN	134734012	A to C	E. coli	562	1	Reduced thiostrepton and micrococcin binding.	Rosendahl, G. and Douthwaite, S. (1994) Nucleic Acids Res. 22, 357-363.	328
329	23S	96092.1	1095		0	HAIRPIN	134734012	A to G	E. coli	562	1	Reduced thiostrepton and micrococcin binding.	Rosendahl, G. and Douthwaite, S. (1994) Nucleic Acids Res. 22, 357-363.	329
330	23S	96092.1	1095		0	HAIRPIN	134734012	del A	E. coli	562	1	trpA UGA suppressor	1) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) Proc. Natl. Acad. Sci. USA. 92, 12309-12313. 2) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) Biochem. Cell Biology, 73, 925-931.	330
331	23S	96092.1	1096		0	HAIRPIN	134734012	del A	E. coli	562	1	trpA UGA suppressor	1) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) Proc. Natl. Acad. Sci. USA. 92, 12309-12313. 2) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) Biochem. Cell Biology, 73, 925-931.	331
332	23S	96092.1	1097		0	HAIRPIN	134734012	del U	E. coli	562	1	trpA UGA suppressor	1) Jemiolo, D.K., Pagel, F.T. and Murgola, E.J. (1995) Proc. Natl. Acad. Sci. USA. 92, 12309-12313. 2) Murgola, E. J., Pagel, F.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995) Biochem. Cell Biology, 73, 925-931.	332
333	23S	96092.1	1098		0	HAIRPIN	134734012	A to U	E. coli	562	1	Normal growth phenotype	Xu, W. and Murgola, E.J. (1996). J. Mol. Biol. 264: 407-411.	333
334	23S	96092.1	1098		0	HAIRPIN	134734012	A to C	E. coli	562	1	trpA UGA suppressor; temperature sensitive	Xu, W. and Murgola, E.J. (1996). J. Mol. Biol. 264: 407-411.	334
335	23S	96092.1	1098		0	HAIRPIN	134734012	A to G	E. coli	562	1	Normal growth phenotype	Xu, W. and Murgola, E.J. (1996). J. Mol. Biol. 264: 407-411.	335
336	23S	96092.1	1098		0	HAIRPIN	134734012	A to G	E. coli	562	1	trpA UGA suppressor; temperature sensitive Double mutant (A1098G/G1093A)	Xu, W. and Murgola, E.J. (1996). J. Mol. Biol. 264: 407-411.	336
337	23S	96092.1	1099		1092	HELIX	134727136	G to A	E. coli	562	1	Reduced L11 binding.	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H.Nierhaus, F. Franceschi,	337
338	23S	96092.1	1099		1092	HELIX	134727136	G to A	E. coli	562	1	Suppression of 1092U temperature sensitivity. a Double mutant (G1099A/C1092U)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	338
339	23S	96092.1	1099		1092	HELIX	134727136	G to A	E. coli	562	1	Suppression of 1068A lethality, but only in absence of erythromycin. Double mutant (G1099A/G1068A)	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	339

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
340	23S	96092.1	1100		1091	HELIX	134727136	C to U	E. coli	562	1	Reduced L11 binding.	1) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H.Nierhaus, F. Franceschi, A.R. ubramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. P	340
341	23S	96092.1	1102		1087	HELIX	134727100	C to U	E. coli	562	1	Reduced L11 binding.	1) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H.Nierhaus, F. Franceschi, A.R. ubramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. P	341
342	23S	96092.1	1104		1055	HELIX	134726956	C to U	E. coli	562	1	Reduced L11 binding.	1) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H.Nierhaus, F. Franceschi, A.R. ubramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. P	342
343	23S	96092.1	1106		1053	HELIX	134726956	G to A	E. coli	562	1	Reduced L11 binding. b; Suppression of G1071A temperature sensitivity. Double mutant (G1106A/G1071A)	1) Douthwaite, S., Vester, B., Aagaard, C., and Rosendahl, G. (1993) In The Translational Apparatus: Structure, Function, Regulation and Evolution. (K.H.Nierhaus, F. Franceschi, A.R. ubramanian, Erdmann, V.A. and B. Wittmann-Liebold, ed.), pp. 339-346. P	343
344	23S	96092.1	1109		0	INTERNAL	134733832	C to U	E. coli	562	1	No effect on L11 binding.	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	344
345	23S	96092.1	1109		0	INTERNAL	134733832	C to U	E. coli	562	1	Partial suppression of temperature sensitivity. Double mutant (C1109U/C1092U)	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	345
346	23S	96092.1	1115		1040	HELIX	134726920	G to A	E. coli	562	1	No effect on L11 binding.	Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403.	346
347	23S	96092.1	1137		1006	HELIX-KNOT	134726776	G to A	E. coli	562	1	With 2058G and erythromycin, lethal when expressed from rrnB promoter.	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	347
348	23S	96092.1	1137		1006	HELIX-KNOT	134726776	G to A	E. coli	562	1	Restores normal growth under pL promoter; (With 2058G and erythromycin) Eyr. Double mutant (G1137A/C1006U)	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	348
349	23S	96092.1	1137		1006	HELIX-KNOT	134726776	G to A	E. coli	562	1	With 2058G and erythromycin, lethal when expressed from rrnB promoter. Double mutant (G1137A/G1138C)	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	349

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
350	23S	96092.1	1137		1006	HELIX-KNOT	134726776	G to A	E. coli	562	1	Restores normal growth under pL promoter; (with 2058G and erythromycin) Eyr. a Double mutant (G1137A/C1006U)	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	350
351	23S	96092.1	1138		1005	HELIX-KNOT	134726776	G to C	E. coli	562	1	With 2058G and erythromycin, lethal when expressed from rrnB promoter. Double mutant (G1138C/G1137A)	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	351
352	23S	96092.1	1138		1005	HELIX-KNOT	134726776	G to C	E. coli	562	1	Restores normal growth under pL promoter; (with 2058G and erythromycin) Eyr. a Double mutant(G1138C/C1005G).	1) Rosendahl, G. and Douthwaite, S. (1995) Nucleic Acids Res. 23, 2396-2403. 2) Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	352
353	23S	96092.1	1138		1005	HELIX-KNOT	134726776	G to C	E. coli	562	1	With 2058G and erythromycin, lethal when expressed from rrnB promoter.	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	353
354	23S	96092.1	1138		1005	HELIX-KNOT	134726776	G to C	E. coli	562	1	Restores normal growth under pL promoter; (With 2058G and erythromycin) Eyr. Double mutant (G1138C/C1005G)	Rosendahl, G., Hansen, L.H., and Douthwaite, S. (1995) J. Mol. Biol. 249, 59-68.	354
355	16S	96080.1	1191		0	MULTISTEM	134700940	A to C	Chlamydomonas reinhardtii	3055	2	High level spectinomycin resistance in Chlamydomonas reinhardtii chloroplast.	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	355
356	16S	96080.1	1191		0	MULTISTEM	134700940	A to G	E. coli	562	1	Inhibits translation, increased level of acetylation, and does not allow S5 to bind. Causes an accumulation of free 30S subunits. Double mutant (U1065C/A1191G).	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486.	356
357	16S	96080.1	1191		0	MULTISTEM	134700940	A to G	Chlamydomonas reinhardtii	3055	2	High level spectinomycin resistance in Chlamydomonas reinhardtii chloroplast.	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	357
358	16S	96080.1	1192		1064	HELIX	134696188	C to A	E. coli	562	1	Spectinomycin. b	1) Sigmund, C.D., Ettayebi, M., and Morgan, E.A. (1984). Nucleic Acids. Res. 12, 4653-4663. 2) Makosky, P.C. and Dahlberg, A.E. (1987). Biochimie 69, 885-889. 3) Bilgin, N., Richter, A.A., Ehrenberg, M., Dahlberg, A.E., and Kurland, C.G. (1990). EMBO J.	358
359	16S	96080.1	1192		1064	HELIX	134696188	C to G	Mycobacterium smegmatis	1772	1	Gain resistance to spectinomycin and macrolides in Mycobacterium smegmatis.	Sander, P., Prammananan, T. and Bottger, E.C. (1995) Mol. Microbiol. 22, 841-848.	359
360	16S	96080.1	1192		1064	HELIX	134696188	C to U	E. coli	562	1	No effect on growth rate. Double mutant (U1341C/C1192U).	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	360
361	16S	96080.1	1192		1064	HELIX	134696188	C to U	E. coli	562	1	Counteracts mutation C1192 and restores spectinomycin binding. No cell growth. Double mutant (A1351C/C1192U).	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	361
362	16S	96080.1	1192		1064	HELIX	134696188	C to A	E. coli	562	1	Spcr.b,c Double mutant (C1192A/G1064U).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	362
363	16S	96080.1	1192		1064	HELIX	134696188	C to G	E. coli	562	1	Spcr; 5-fold lower translational activity. b,c Double mutant (C1192G/G1064C).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	363

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
364	16S	96080.1	1192		1064	HELIX	134696188	C to U	E. coli	562	1	Spcr.b,c Double mutant (C1192U/G1064A).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	364
365	16S	96080.1	1192		1064	HELIX	134696188	C to G	E. coli	562	1	Spectinomycin. b	1) Sigmund, C.D., Ettayebi, M., and Morgan, E.A. (1984). Nucleic Acids. Res. 12, 4653-4663. 2) Makosky, P.C. and Dahlberg, A.E. (1987). Biochimie 69, 885-889. 3) Bilgin, N., Richter, A.A., Ehrenberg, M., Dahlberg, A.E., and Kurland, C.G. (1990). EMBO J.	365
366	16S	96080.1	1192		1064	HELIX	134696188	C to U	E. coli	562	1	Spectinomycin. b	1) Sigmund, C.D., Ettayebi, M., and Morgan, E.A. (1984). Nucleic Acids. Res. 12, 4653-4663. 2) Makosky, P.C. and Dahlberg, A.E. (1987). Biochimie 69, 885-889. 3) Bilgin, N., Richter, A.A., Ehrenberg, M., Dahlberg, A.E., and Kurland, C.G. (1990). EMBO J.	366
367	16S	96080.1	1192		1064	HELIX	134696188	C to U	E. coli	562	1	Spcr.b,c Double mutant (G1064A/C1192U).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	367
368	16S	96080.1	1192		1064	HELIX	134696188	C to G	E. coli	562	1	Spcr; 5-fold lower translational activity. b,c Double mutant (G1064C/C1192G).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	368
369	16S	96080.1	1192		1064	HELIX	134696188	C to A	E. coli	562	1	Spcr.b,c Double mutant (G1064U/C1192A).	Brink, M.F., Brink, G., Verbeet, M. Ph., and deBoer, H.A. (1994). Nucleic Acids Research 22, 325-331.	369
370	16S	96080.1	1192		1064	HELIX	134696188	C to G	Mycobacterium smegmatis	1772	1	Spectinomycin resistant. b	Sander, P. Pramananan T, Meier A, Frischkorn K, Bottger E.C. 1997. The role of ribosomal RNAs in macrolide resistance. Molecular Biology 26 (3): 469-480.	370
371	16S	96080.1	1193		1063	HELIX	134696188	G to A	Chlamydomonas reinhardtii	3055	2	Low level spectinomycin resistance in Chlamydomonas reinhardtii chloroplast.	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	371
372	16S	96080.1	1193		1063	HELIX	134696188	G to A	Nicotiana	4085	2	Low level spectinomycin resistance in Nicotiana chloroplast.	Fromm, H., Edelman, M., Aviv, D. and Galun, E. (1987). EMBO J. 6, 3233-3237.	372
373	16S	96080.1	1199	a	1058	HELIX	134696152	U to C	E. coli	562	1	Increased UGA read-through. b	Goringe, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	373
374	16S	96080.1	1199	a	1058	HELIX	134696152	U to C	E. coli	562	1	Dominant lethal. b Double mutant (U1199C/U1202C).	Goringe, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	374
375	16S	96080.1	1199	a	1058	HELIX	134696152	U to C	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199C/C1200U).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	375
376	16S	96080.1	1199		1058	HELIX	134696152	U to G	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (C1200G/U1199G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	376

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377	16S	96080.1	1199		1058	HELIX	134696152	U to C	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (C1200U/U1199C).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	377
378	16S	96080.1	1199		1058	HELIX	134696152	U to C	E. coli	562	1	Dominant lethal. b Double mutant (U1202C/U1199C).	Goringer, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	378
379	16S	96080.1	1199		1058	HELIX	134696152	U to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (C1203G/U1199G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	379
380	16S	96080.1	1199	a	1058	HELIX	134696152	U to C	E. coli	562	1	Stimulates initiation from a non-AUG initiation codon. Double mutant (U1199C/C1200U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	380
381	16S	96080.1	1199	a	1058	HELIX	134696152	U to G	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199G/C1200G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	381
382	16S	96080.1	1199	a	1058	HELIX	134696152	U to G	E. coli	562	1	Stimulates initiation from a non-AUG initiation codon. Double mutant (U1199G/C1200G).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	382
383	16S	96080.1	1199	a	1058	HELIX	134696152	U to G	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199G/C1203G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	383
384	16S	96080.1	1200		0	BULGE	134699752	C to U	E. coli	562	1	No effect on growth rate; effect on translational fidelity. b,c	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	384
385	16S	96080.1	1200		0	BULGE	134699752	C to U	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199C/C1200U).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	385
386	16S	96080.1	1200		0	BULGE	134699752	C to U	E. coli	562	1	Stimulates initiation from a non-AUG initiation codon. Double mutant (U1199C/C1200U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	386
387	16S	96080.1	1200		0	BULGE	134699752	C to G	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199G/C1200G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	387
388	16S	96080.1	1200		0	BULGE	134699752	C to G	E. coli	562	1	Stimulates initiation from a non-AUG initiation codon. Double mutant (U1199G/C1200G).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	388
389	16S	96080.1	1200		0	BULGE	134699752	C to G	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (C1200G/U1199G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	389
390	16S	96080.1	1200		0	BULGE	134699752	C to U	E. coli	562	1	Severe effects on growth rate, mutant ribosome incorporation into polysomes and translational fidelity. b,c Double mutant (C1200U/U1199C).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	390
391	16S	96080.1	1202		0	BULGE	134699752	U to C	E. coli	562	1	Increased UGA read-through. b	Goringer, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	391
392	16S	96080.1	1202		0	BULGE	134699752	U to C	E. coli	562	1	Dominant lethal. b Double mutant (U1202C/U1199C).	Goringer, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	392
393	16S	96080.1	1202		0	BULGE	134699752	U to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (U1202G/C1203G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	393

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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394	16S	96080.1	1202		0	BULGE	134699752	U to C	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (U1202C/C1203U).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	394
395	16S	96080.1	1202		0	BULGE	134699752	U to C	E. coli	562	1	Dominant lethal. b Double mutant (U1199C/U1202C).	Goringer, H.U., Hijazi, K.A., Murgola, E.J., and Dahlberg, A.E. (1991). Proc. Natl. Acad. Sci. U.S.A. 88, 6603-6607.	395
396	16S	96080.1	1202		0	BULGE	134699752	U to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (C1203G/U1202G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	396
397	16S	96080.1	1203		1057	HELIX	134696116	C to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (U1202G/C1203G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	397
398	16S	96080.1	1203		1057	HELIX	134696116	C to U	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (U1202C/C1203U).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	398
399	16S	96080.1	1203		1057	HELIX	134696116	C to G	E. coli	562	1	Severely retarded growth rate. b,c Double mutant (U1199G/C1203G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	399
400	16S	96080.1	1203		1057	HELIX	134696116	C to U	E. coli	562	1	No effect on growth rate or translational accuracy. b,c	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	400
401	16S	96080.1	1203		1057	HELIX	134696116	C to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (C1203G/U1199G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	401
402	16S	96080.1	1203		1057	HELIX	134696116	C to G	E. coli	562	1	No effect on growth rate or translational accuracy. b,c Double mutant (C1203G/U1202G).	Moine, H. and Dahlberg, A. (1994). J. Mol. Biol. 243, 402-412.	402
403	23S	96092.1	1206		1240	HELIX	134727280	G to A	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	403
404	23S	96092.1	1206		1240	HELIX	134727280	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1206A/G1228A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	404
405	23S	96092.1	1207		1239	HELIX	134727280	C to U	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	405
406	23S	96092.1	1207		1239	HELIX	134727280	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1207U/C1243U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	406
407	16S	96080.1	1207		1051	HELIX	134696080	G to U	E. coli	562	1	Dominant lethal.b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	407
408	16S	96080.1	1207		1051	HELIX	134696080	G to C	E. coli	562	1	Dominant lethal.b	Jemiolo, D.K., Taurence, J.S., and Giese, S. (1991). Nucleic Acids Res. 19, 4259-4265.	408
409	23S	96092.1	1208		1238	HELIX	134727280	C to U	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	409
410	23S	96092.1	1208		1238	HELIX	134727280	C to U	E. coli	562	1	Erythromycin sensitive. a Double mutant (C1208U/C1211U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	410
411	23S	96092.1	1208		1238	HELIX	134727280	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1208U/C1243U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	411
412	23S	96092.1	1211		0	INTERNAL	134734156	C to U	E. coli	562	1	Erythromycin sensitive. a Double mutant (C1211U/C1208U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	412

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
413	23S	96092.1	1215		1234	HELIX	134727316	G to A	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	413
414	23S	96092.1	1218		1231	HELIX	134727316	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1218A/G1245A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	414
415	23S	96092.1	1220		1229	HELIX	134727316	G to A	E. coli	562	1	Erythromycin resistant. a Double mutant (G1220A/G1239A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	415
416	23S	96092.1	1221		1228	HELIX	134727316	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1221U/C1229U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	416
417	23S	96092.1	1221		1228	HELIX	134727316	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1221U/C1233U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	417
418	23S	96092.1	1221		1228	HELIX	134727316	C to U	E. coli	562	1	Erythromycin sensitive. a Double mutant (C1221U/C1243U)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	418
419	23S	96092.1	1225		0	HAIRPIN	134734192	?1225	E. coli	562	1	Erythromycin sensitive. a Double deletion (del1225/del1226)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	419
420	23S	96092.1	1225		0	HAIRPIN	134734192	G to A	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	420
421	23S	96092.1	1226		0	HAIRPIN	134734192	?1225	E. coli	562	1	Erythromycin sensitive. a Double deletion (?1226/?1225)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	421
422	23S	96092.1	1227		1222	HELIX	134727316	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1227A/G1236A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	422
423	23S	96092.1	1228		1221	HELIX	134727316	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1228A/G1206A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	423
424	23S	96092.1	1229		1220	HELIX	134727316	C to U	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	424
425	23S	96092.1	1230		1219	HELIX	134727316	?1230	E. coli	562	1	Erythromycin sensitive. a Double deletion (?1230/?1231)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	425
426	23S	96092.1	1231		1218	HELIX	134727316	?1231	E. coli	562	1	Erythromycin sensitive. a Double deletion (?1231/?1230)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	426
427	23S	96092.1	1232		1217	HELIX	134727316	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1232A/G1238A)	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	427
428	23S	96092.1	1233		1216	HELIX	134727316	C to U	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	428
429	23S	96092.1	1234		1215	HELIX	134727316	del1234/del1235	E. coli	562	1	Erythromycin sensitive. a Double mutant (U1234C/del1235)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	429

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430	23S	96092.1	1234		1215	HELIX	134727316	U to C	E. coli	562	1	Erythromycin sensitive. a	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	430
431	23S	96092.1	1235		0	INTERNAL	134734156	del1235/del1234	E. coli	562	1	Erythromycin sensitive. a Double mutant (? 1235/U1234C)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	431
432	23S	96092.1	1235		0	INTERNAL	134734156	G to A	E. coli	562	1	Erythromycin sensitive. a	Dam, M., Douthwaite, S., Tenson, T. and Mankin, A.S. (1996) J. Mol. Biol. 259, 1-6.	432
433	23S	96092.1	1236		0	INTERNAL	134734156	G to A	E. coli	562	1	Erythromycin sensitive. a	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	433
434	23S	96092.1	1236		0	INTERNAL	134734156	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1236A/G1227A)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	434
435	23S	96092.1	1238		1208	HELIX	134727280	G to A	E. coli	562	1	Erythromycin sensitive. a	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	435
436	23S	96092.1	1238		1208	HELIX	134727280	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1238A/G1232A)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	436
437	23S	96092.1	1239		1207	HELIX	134727280	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1239A/G1220A)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	437
438	23S	96092.1	1243		1202	HELIX	134727244	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1243U/C1208U)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	438
439	23S	96092.1	1243		1202	HELIX	134727244	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1243U/C1221U)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	439
440	16S	96080.1	1243		1294	HELIX	134696512	U to A	E. coli	562	1	Impaired growth.	Poot, R.A., Jeeniga, R.E., Pleij, C.W.A., and van Duin, J. (1997). FEBS Letters 401, 175-179.	440
441	23S	96092.1	1243		1202	HELIX	134727244	C to U	E. coli	562	1	Erythromycin resistant. a Double mutant (C1243U/C1207).	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	441
442	16S	96080.1	1244		1293	HELIX	134696512	G to A	E. coli	562	1	(With U1192)Spcs.b Double mutant (C1293U/G1244A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	442
443	16S	96080.1	1244		1293	HELIX	134696512	G to A	E. coli	562	1	(With U1192)Spcs.b Double mutant (G1244A/C1293U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	443
444	16S	96080.1	1245		1292	HELIX	134696512	C to U	E. coli	562	1	(With U1192) Restores Spc abolished by G1292A alone. b Double mutant (C1245U/G1292A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	444
445	23S	96092.1	1245		1200	HELIX	134727244	G to A	E. coli	562	1	Erythromycin sensitive. a Double mutant (G1245A/G1218A)	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	445
446	16S	96080.1	1245		1292	HELIX	134696512	C to U	E. coli	562	1	(With U1192) Restores Spc abolished by G1292A alone. b Double mutant (G1292A/C1245U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	446
447	23S	96092.1	1248		0	INTERNAL	134734084	G to A	E. coli	562	1	Erythromycin sensitive. a	Douthwaite, S., Powers, T., Lee, J.Y., and Noller, H.F. (1989) J. Mol. Biol. 209, 655-665.	447
448	23S	96092.1	1262		2017	HELIX	134727352	A to G	E. coli	562	1	With erythromycin; lethal	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	448
449	23S	96092.1	1262		2017	HELIX	134727352	A to C	E. coli	562	1	With erythromycin; lethal	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	449

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
450	23S	96092.1	1262		2017	HELIX	134727352	A to U	E. coli	562	1	With erythromycin; reduced growth rate	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	450
451	23S	96092.1	1262		2017	HELIX	134727352	A to C	E. coli	562	1	With erythromycin; reduced growth rate Double mutant (A1262C/U2017G)	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	451
452	23S	96092.1	1262		2017	HELIX	134727352	A to G	E. coli	562	1	Suppression of growth effects; Wild-type growth on erythromycin Double mutant (A1262G/U2017C)	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	452
453	23S	96092.1	1262		2017	HELIX	134727352	A to U	E. coli	562	1	Suppression of growth effects; Wild-type growth on erythromycin Double mutant (A1262U/U2017A)	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	453
454	23S	96092.1	1262		2017	HELIX	134727352	A to U	E. coli	562	1	With erythromycin; reduced growth rate Double mutant (A1262U/U2017G)	Aagaard, C., and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	454
455	16S	96080.1	1292		1245	HELIX	134696512	G to A	E. coli	562	1	(With U1192) Spcts recessive. b	Triman, K., Becker, E., Dammal, C., Katz, J., Mori, H., Douthwaite, S., Yapjajakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	455
456	16S	96080.1	1292		1245	HELIX	134696512	G to A	E. coli	562	1	(With U1192) Restores Spc abolished by G1292A alone. b Double mutant (G1292A/C1245U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	456
457	16S	96080.1	1292		1245	HELIX	134696512	G to A	E. coli	562	1	(With U1192) Restores Spc abolished by G1292A alone. b Double mutant (C1245U/G1292A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	457
458	16S	96080.1	1293		1244	HELIX	134696512	C to U	E. coli	562	1	(With U1192)Spcs.b Double mutant (G1244A/C1293U).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	458
459	16S	96080.1	1293		1244	HELIX	134696512	C to U	E. coli	562	1	(With U1192) Spcts recessive. b	Triman, K., Becker, E., Dammal, C., Katz, J., Mori, H., Douthwaite, S., Yapjajakis, C., Yoast, S., and Noller, H.F. (1989). J. Mol. Biol. 209, 645-653.	459
460	16S	96080.1	1293		1244	HELIX	134696512	C to U	E. coli	562	1	(With U1192)Spcs.b Double mutant (C1293U/G1244A).	Triman, K. (1995). J. Bacteriol. 177, 4514-4516.	460
461	16S	96080.1	1341	a	942	HELIX	134695720	U to C	E. coli	562	1	Increased S7 affinity. c	Dragon, F., Payant, C., and Brakier-Gingras, L. (1994). J. Mol. Biol. 244, 74-85.	461
462	16S	96080.1	1341	a	942	HELIX	134695720	U to C	E. coli	562	1	No effect on growth rate.	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	462
463	16S	96080.1	1341	a	942	HELIX	134695720	U to C	E. coli	562	1	No effect on growth rate. Double mutant (U1341C/C1192U).	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	463
464	16S	96080.1	1351		1371	HELIX	134696728	A to C	E. coli	562	1	Counteracts mutation C1192 and restores spectinomycin binding. No cell growth. Double mutant (A1351C/C1192U).	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	464
465	16S	96080.1	1351		1371	HELIX	134696728	U to C	E. coli	562	1	No effect on growth rate.	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	465
466	16S	96080.1	1351		1371	HELIX	134696728	U to C	E. coli	562	1	Reduced S7 affinity. c	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	466
467	16S	96080.1	1357		1365	HELIX	134696728	A to C	E. coli	562	1	No effect on S7 binding. c	Dragon, F., Spickler, C., Pinard, R., Carriere, J., and Brakier-Gingras, L. (1996). 259, 207-215.	467
468	16S	96080.1	1386		931	HELIX	134695648	G to A	N. tabacum	4097		Spectinomycin resistance in N. tabacum.	Svab Z., and Maliga, P. (1991). Mol. Gen. Genet. 228, 316-319.	468
Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #

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469	16S	96080.1	1388		929	HELIX	134695648	C to U	E. coli	562	1	No effect on growth rate. b	Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643.	469
470	16S	96080.1	1389		928	HELIX	134695648	C to U	E. coli	562	1	No effect on growth rate. b	Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643.	470
471	16S	96080.1	1394	a	0	BULGE	134700076	A to C	E. coli	562	1	Wild-type tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	471
472	16S	96080.1	1394	a	0	BULGE	134700076	del A	E. coli	562	1	Negligible tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	472
473	16S	96080.1	1394	a	0	BULGE	134700076	A to G	E. coli	562	1	Wild-type tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	473
474	16S	96080.1	1394	a	0	BULGE	134700076	A to U	E. coli	562	1	Wild-type tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). J. Mol. Biol. 250, 407-419.	474
475	16S	96080.1	1395	a	922	HELIX	134695576	C to U	E. coli	562	1	Dominant lethal. b	Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146.	475
476	16S	96080.1	1395	a	922	HELIX	134695576	C to U	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	476
477	16S	96080.1	1395	a	922	HELIX	134695576	C to U	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over C1395U alone. Double mutant (C1395U/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	477
478	16S	96080.1	1397	a	0	FREE	134701192	C to U	E. coli	562	1	No effect on growth rate. b	Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643.	478
479	16S	96080.1	1397	a	0	FREE	134701192	del C	E. coli	562	1	Impaired in initiation of translation. c	1) Denman, R., Negre, D., Cunningham, P.R., Nurse, K., Colgan, J., Weitzmann, C., and Ofengand, J. (1989). Biochemistry 28, 1012-1019. 2) Denman, R., Weitzmann, C., Cunningham, P.R., Nurse, D., Nurse, K., Colgan, J., Pan, Y.-C., Miedel, M., and Ofengand,	479
480	16S	96080.1	1398	a	0	FREE	134701192	del A	E. coli	562	1	Impaired in initiation of translation. c	1) Denman, R., Negre, D., Cunningham, P.R., Nurse, K., Colgan, J., Weitzmann, C., and Ofengand, J. (1989). Biochemistry 28, 1012-1019. 2) Denman, R., Weitzmann, C., Cunningham, P.R., Nurse, D., Nurse, K., Colgan, J., Pan, Y.-C., Miedel, M., and Ofengand,	480
481	16S	96080.1	1399	a	1504	HELIX	134696764	C to A	E. coli	562	1	Lethal under natural promoter. b	Rottmann, N., Klewvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90.	481

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482	16S	96080.1	1399	a	1504	HELIX	134696764	C to U	E. coli	562	1	Slight reduction in cellular growth rate. b	Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643.	482
483	16S	96080.1	1399	a	1504	HELIX	134696764	C to A	E. coli	562	1	Lethal under natural promoter. Ribosomes are totally inactive. b Double mutant (C1399A/G1401C).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	483
484	16S	96080.1	1399	a	1504	HELIX	134696764	C to A	E. coli	562	1	Lethal under natural promoter. Severe impairment of ribosome function. b Double mutant (C1399A/G1401U).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	484
485	16S	96080.1	1399		1504	HELIX	134696764	C to A	E. coli	562	1	Lethal under natural promoter. Ribosomes are totally inactive. b Double mutant (G1401C/C1399A).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	485
486	16S	96080.1	1399		1504	HELIX	134696764	C to A	E. coli	562	1	Lethal under natural promoter. Severe impairment of ribosome function. b Double mutant (G1401U/C1399A).	1) Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95. 2) Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90. 3) Thoma	486
487	16S	96080.1	1400	a	0	INTERNAL	134700112	C to A	E. coli	562	1	Lethal under natural promoter; inhibited ribosomal activity. b,c	Hui, A.S., Eaton, D.H., and DeBoer, H.A. (1988). EMBO J. 7, 4383-4388.	487
488	16S	96080.1	1400	a	0	INTERNAL	134700112	C to G	E. coli	562	1	Inhibited ribosomal activity. b,c	Krzyzosiak, W., Denman, R., Nurse, K., Hellmann, W., Boublik, M., Gehrke, C.W., Agris, P.F., and Ofengand, J. (1987). Biochemistry 26, 2353-2364.	488
489	16S	96080.1	1400	a	0	INTERNAL	134700112	C to U	E. coli	562	1	No effect on ribosomal activity. b,c	Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643.	489
490	16S	96080.1	1400	a	0	INTERNAL	134700112	del C	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	490
491	16S	96080.1	1400	a	0	INTERNAL	134700112	del C	E. coli	562	1	Dominant lethal. b Initiation-dependent protein synthesis blocked. c	Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146.	491
492	16S	96080.1	1400	a	0	INTERNAL	134700112	del C	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over [[Delta]]C1400 alone. Double mutant (? C1400/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	492
493	16S	96080.1	1401	a	1501	HELIX	134696800	G to A	E. coli	562	1	Lethal under natural promoter. b	Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146.	493

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
494	16S	96080.1	1401	a	1501	HELIX	134696800	G to C	E. coli	562	1	G1401C disrupted tRNA binding and polypeptide synthesis. c	Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90.	494
495	16S	96080.1	1401	a	1501	HELIX	134696800	G to C	E. coli	562	1	Lethal under natural promoter. Ribosomes are totally inactive. b Double mutant (G1401C/C1399A).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	495
496	16S	96080.1	1401	a	1501	HELIX	134696800	G to C	E. coli	562	1	Impaired A-site function; enhanced tRNA fMet selectivity. c Double mutant (G1401C/C1501G).	1) Cunningham, P.R., Nurse, K., Weitzmann, C.J., Negre, D., and Ofengand, J. (1992). Biochemistry 31, 7629-7637. 2) Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Plumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022. 3) Ringgu	496
497	16S	96080.1	1401	a	1501	HELIX	134696800	G to U	E. coli	562	1	Lethal under natural promoter. Severe impairment of ribosome function. b Double mutant (G1401U/C1399A).	1) Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95. 2) Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90. 3) Thoma	497
498	16S	96080.1	1401	a	1501	HELIX	134696800	del G	E. coli	562	1	Lethal under natural promoter. b All ribosomal functions blocked. c	1) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 2) Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90. 3) Denman, R., Negre, D., Cunningham	498
499	16S	96080.1	1401		1501	HELIX	134696800	G to C	E. coli	562	1	Induced appearance of numerous reactive changes in 1400/1500 regions and 1360/1375 regions; decrease reactivity in more distant 1365/1375 regions; strengthened conformation of helix 44. c	Moine H, Nurse K, Ehresmann B, Ehresmann C, Ofengand J. 1997. Conformational Analysis of Escherichia coli 30S Ribosomes Containing the Single-Base Mutations G530U, U1498G, G1401C, and C1501G and the Double-Base Mutation G1401C/C1501G. Biochemistry 36: 137	499
500	16S	96080.1	1401		1501	HELIX	134696800	G1401C/C1501G	E. coli	562	1	Showed fewer reactivity changes when compared to wild type; hyperreactive toward kethoxal; partially compensated for destabilizing effect of single mutations. c	Moine H, Nurse K, Ehresmann B, Ehresmann C, Ofengand J. 1997. Conformational Analysis of Escherichia coli 30S Ribosomes Containing the Single-Base Mutations G530U, U1498G, G1401C, and C1501G and the Double-Base Mutation G1401C/C1501G. Biochemistry 36: 137	500
501	16S	96080.1	1401	a	1501	HELIX	134696800	G to U	E. coli	562	1	G1401C disrupted tRNA binding and polypeptide synthesis. c	Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90.	501

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
502	16S	96080.1	1401		1501	HELIX	134696800	G to C	E. coli	562	1	Lethal under natural promoter. Ribosomes are totally inactive. b Double mutant (C1399A/G1401C).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	502
503	16S	96080.1	1401		1501	HELIX	134696800	G to U	E. coli	562	1	Lethal under natural promoter. Severe impairment of ribosome function. b Double mutant (C1399A/G1401U).	Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95.	503
504	16S	96080.1	1401		1501	HELIX	134696800	G to C	E. coli	562	1	Impaired A-site function; enhanced tRNA fMet selectivity. c Double mutant (C1501G/G1401C).	1) Cunningham, P.R., Nurse, K., Weitzmann, C.J., Negre, D., and Ofengand, J. (1992). Biochemistry 31, 7629-7637. 2) Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022. 3) Ringgu	504
505	16S	96080.1	1401		1501	HELIX	134696800	C to G	E. coli	562	1	Restored tRNA binding. c Double mutant (G1497C/C1401G).	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643. 2) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 3) Denman, R., Negre, D., Cunningham, P.R.,	505
506	16S	96080.1	1402	a	1500	HELIX	134696800	C to U	E. coli	562	1	Slight reduction in cellular growth rate. b	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643. 2) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146.	506
507	16S	96080.1	1402	a	1500	HELIX	134696800	del C	E. coli	562	1	Initiation-dependent protein synthesis blocked. b	1) Denman, R., Negre, D., Cunningham, P.R., Nurse, K., Colgan, J., Weitzmann, C., and Ofengand, J. (1989). Biochemistry 28, 1012-1019. 2) Denman, R., Weitzmann, C., Cunningham, P.R., Negre, D., Nurse, K., Colgan, J., Pan, Y.-C., Miedel, M., and Ofengand	507
508	16S	96080.1	1404	a	1497	HELIX	134696836	C to U	E. coli	562	1	Slight reduction in cellular growth rate. b Inhibited tRNA binding. c	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643. 2) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 3) Denman, R., Negre, D., Cunningham, P.R.,	508

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
509	16S	96080.1	1404	a	1497	HELIX	134696836	C1404G/G1497C	E. coli	562	1	Restored tRNA binding. c	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643. 2) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 3) Denman, R., Negre, D., Cunningham, P.R.,	509
510	16S	96080.1	1405	a	1496	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	510
511	16S	96080.1	1405	a	1496	HELIX	134696836	G to C	E. coli	562	1	Significantly reduced interaction with Paromomycin at positions 1491 and 1494.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	511
512	16S	96080.1	1405	a	1496	HELIX	134696836	G to C	E. coli	562	1	No affect on Paromomycin binding. Double mutant (G1405C/G1496G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	512
513	16S	96080.1	1405		1496	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c Double mutant (G1497C/G1405C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	513
514	16S	96080.1	1405		1496	HELIX	134696836	G to C	E. coli	562	1	Restored tRNA binding. c Double mutant (C1496G/G1405C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	514
515	16S	96080.1	1405	a	1496	HELIX	134696836	G to C	E. coli	562	1	Restored tRNA binding. c Double mutant (G1405C/G1496G).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	515
516	16S	96080.1	1405	a	1496	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c Double mutant (G1405C/G1497C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	516
517	16S	96080.1	1406		0	INTERNAL	134700184	U to A	E. coli	562	1	No affect on Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	517
518	16S	96080.1	1406		0	INTERNAL	134700184	U to G	E. coli	562	1	No affect on Paromomycin binding. Double mutant (U1406G/U1495G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	518
519	16S	96080.1	1406		0	INTERNAL	134700184	U to C	E. coli	562	1	No affect on Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	519
520	16S	96080.1	1406		0	INTERNAL	134700184	U to G	E. coli	562	1	No effect on Paramomycin binding. Double mutant (U1495G/U1406G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	520

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
521	16S	96080.1	1406		0	INTERNAL	134700184	U to A	E. coli	562	1	Nonlethal; upon introduction, the pattern of chemical modification in the absence of paromycin is indistinguishable from that of wildtype 30S subunits; no discernable reduction in affinity. a	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	521
522	16S	96080.1	1406		0	INTERNAL	134700184	U to C	E. coli	562	1	Lethal; causes changes in the chemical probing pattern of 16S rRNA in mutant 30S subunits, in addition to detrimental effects of these mutations; causes changes in the conformation of the A site that extend to lower stem of the decoding region; no discena	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	522
523	16S	96080.1	1407		1494	HELIX	134696872	U1407G/G1494C	E. coli	562	1	Reduced affinity for the aminoglycoside paromomycin. a	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	523
524	16S	96080.1	1407	a	1494	HELIX	134696872	C to G	E. coli	562	1	Severely impaired Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	524
525	16S	96080.1	1407	a	1494	HELIX	134696872	C to U	E. coli	562	1	Dominant Lethal. b	1) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 2) Zimmerman, R.A., Thomas, C.L., and Wower, J. (1990). In The Ribosome: Structure, Function and Evolution (W.E. Hill, A. Dahlberg, R.A	525
526	16S	96080.1	1407	a	1494	HELIX	134696872	C to U	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	526
527	16S	96080.1	1407	a	1494	HELIX	134696872	C to G	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407G/G1494C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	527
528	16S	96080.1	1407	a	1494	HELIX	134696872	C to U	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407U/G1494G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	528
529	16S	96080.1	1407	a	1494	HELIX	134696872	C to U	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407U/G1494A).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	529
530	16S	96080.1	1407	a	1494	HELIX	134696872	C to U	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over C1407U alone. Double mutant (C1407U/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). Nucleic Acids Research 25, 1187-1193.	530

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531	16S	96080.1	1408		0	INTERNAL	134700220	A to C	E. coli	562	1	Moderate reduction of Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	531
532	16S	96080.1	1408		0	INTERNAL	134700220	A to G	Mycobacterium smegmatis	1772	1	Gain resistance to gentamicin, amikacin, or tobramycin in Mycobacterium smegmatis.	Sander, P., Prammananan, T. and Bottger, E.C. (1995) Mol. Microbiol. 22, 841-848.	532
533	16S	96080.1	1408		0	INTERNAL	134700220	A to G	Chlamydomonas reinhardtii	3055		High level neamine and kanamycin resistance in C. reinhardtii.	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989) Genetics 123:281-292.	533
534	16S	96080.1	1408		0	INTERNAL	134700220	A to G	E. coli	562	1	Weak reduction of Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	534
535	16S	96080.1	1408		0	INTERNAL	134700220	A to U	E. coli	562	1	Large reduction of Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	535
536	16S	96080.1	1408		0	INTERNAL	134700220	A to G	E. coli	562	1	Reduced affinity for the aminoglycoside paromomycin. a	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	536
537	16S	96080.1	1408		0	INTERNAL	134700220	A to G	Mycobacterium abscessus	36809	1	Causes rsistance to amikacin, karamycin, gentamicin, tobramycin, and neomycin. c	Prammananan T, Sander P, Brown B.A., Frischkorn K, Onyi G.O., Zhang Y, Bottger E.C., Wallace R.J. 1998. A Single 16S Ribosomal RNA Substitution Is Responsible for Resistance to Amikacin and Other 2-Deoxystreptamine Aminoglycoside in Mycobacterium abscessu	537
538	16S	96080.1	1408		0	INTERNAL	134700220	A to G	Mycobacterium chelonae	1774	1	Causes resistance to amikacin, karamycin, gentamicin, tobramycin and neomycin. c	Prammananan T, Sander P, Brown B.A., Frischkorn K, Onyi G.O., Zhang Y, Bottger E.C., Wallace R.J. 1998. A Single 16S Ribosomal RNA Substitution Is Responsible for Resistance to Amikacin and Other 2-Deoxystreptamine Aminoglycoside in Mycobacterium abscessu	538
539	16S	96080.1	1408		0	INTERNAL	134700220	A to G	Mycobacterium smegmatis	1772	1	Aminoglycoside resistant. b	Sander, P., Prammananan, T. and Bottger, E.C. (1997) Mol. Microbiol. 26, (3): 469-480.	539
540	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O' Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	540
541	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Lethal. b	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	541

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
542	16S	96080.1	1409		1491	HELIX	134696908	C1409U/G1491C	E. coli	562	1	Decreased binding to the paromomycin-coupled matrix. c	Blanchard S.C., Fourmy D, Eason R.G., Puglisi J.D. 1998. rRNA Chemical Groups Required for Aminoglycoside Binding. Biochemistry 37: 7716-7724.	542
543	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b Double mutant (G1491A/C1409A).	O'Connell, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	543
544	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	No drug resistance. Double mutant (G1491A/C1409G).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	544
545	16S	96080.1	1409		1491	HELIX	134696908	C to U	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (G1491A/C1409U).	O'Connell, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	545
546	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (G1491C/C1409G).	O'Connell, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	546
547	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	No drug resistance. b Double mutant (G1491C/C1409G).	De Stasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	547
548	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Ribosome activity reduced. b Double mutant (C1411G/C1409A).	Hui, A. and DeBoer, H.A. (1987). Proc. Natl. Acad. Sci U.S.A. 84, 4762-4766.	548
549	16S	96080.1	1409		1491	HELIX	134696908	C to G	Yeast mitochondria	4932	3	Paromomycin resistance in yeast mitochondria.	Li, M., Tzagoloff, A., Underbrink-Lyon, K. and Martin, N.C. (1982). J. Biol. Chem. 257, 5921-5928.	549
550	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connell, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	550
551	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	Lethal. b	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	551
552	16S	96080.1	1409		1491	HELIX	134696908	C to U	Chlamydomonas reinhardtii	3055		Low level neamine and kanamycin resistance in C. reinhardtii.	Harris, E.H., Burkhart, B.D., Gilham, N.W. and Boynton, J.E. (1989). Genetics 123, 281-292.	552
553	16S	96080.1	1409		1491	HELIX	134696908	C to U	E. coli	562	1	No drug resistance. b	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	553
554	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Ribosome activity reduced. Double mutant (C1409A/G1491U).	1) Hui, A.S., Eaton, D.H., and DeBoer, H.A. (1988). EMBO J. 7, 4383-4388. 2) DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	554

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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555	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Ribosome activity reduced. b Double mutant (C1409A/C1411G).	Hui, A. and DeBoer, H.A. (1987). Proc. Natl. Acad. Sci U.S.A. 84, 4762-4766.	555
556	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Slightly reduced interaction with Paromomycin. Double mutant (C1409A/G1491U).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	556
557	16S	96080.1	1409		1491	HELIX	134696908	C to A	E. coli	562	1	Increased frameshifting and readthrough of nonsense codons. Double mutant (C1409A/G1491A).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	557
558	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (C1409G/G1491C).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	558
559	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	No drug resistance. b Double mutant (C1409G/G1491C).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	559
560	16S	96080.1	1409		1491	HELIX	134696908	C to G	E. coli	562	1	Slightly reduced interaction with Paromomycin. Double mutant (C1409G/G1491C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	560
561	16S	96080.1	1409		1491	HELIX	134696908	C to U	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (C1409U/G1491A).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	561
562	16S	96080.1	1409		1491	HELIX	134696908	C to U	E. coli	562	1	No drug resistance. Double mutant (C1409U/G1491A).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	562
563	16S	96080.1	1411		1489	HELIX	134696908	C to G	E. coli	562	1	Ribosome activity reduced. b Double mutant (C1411G/C1409A).	Hui, A. and DeBoer, H.A. (1987). Proc. Natl. Acad. Sci U.S.A. 84, 4762-4766.	563
564	16S	96080.1	1411		1489	HELIX	134696908	C to G	E. coli	562	1	Ribosome activity reduced. b Double mutant (C1409A/C1411G).	Hui, A. and DeBoer, H.A. (1987). Proc. Natl. Acad. Sci U.S.A. 84, 4762-4766.	564
565	16S	96080.1	1416		1484	HELIX	134696908	G to U	E. coli	562	1	Reduced association between 30S and 50S subunits.	1) Meier, N., Goring, H.U., Kleuvers, B., Scheibe, U., Eberle, J., Szymkowiak, C., Zacharias, M., and Wagner, R. (1986). FEBS Lett. 204, 89-95. 2) Rottmann, N., Kleuvers, B., Atmadja, J., and Wagner, R. (1988). Eur. J. Biochem. 177, 81-90.	565
566	23S	96092.1	1423		1575	HELIX	134727964	G to A	E. coli	562	1	Suppressed requirement for 4.5S RNA in translation of natural mRNAs by cell extracts. c	O'Connor, M., Brunelli, C. A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	566

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
567	16S	96080.1	1431		0	INTERNAL	134700292	A to G	E. coli	562	1	Nonsense suppressor. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). <i>Biochem. Cell Biol.</i> 73, 925-931.	567
568	16S	96080.1	1469		0	INTERNAL	134700292	C to U	E. coli	562	1	Slow growth rate; ribosomal ambiguity phenotype. a	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). <i>Nucleic Acids Res.</i> 13, 8631-8643. 2) Allen, P.N. and Noller, H.F. (1991). <i>Cell</i> 66, 141-148.	568
569	16S	96080.1	1479		1421	HELIX	134696944	C to G	Yeast mitochondria	4932	3	Suppression of ribosomal frameshifting in yeast mitochondria.	Weiss-Brummer, B. and Huttenhofer, A. (1989) <i>Mol. Gen. Genet.</i> 217: 362-369.	569
570	16S	96080.1	1483	a	0	INTERNAL	134700256	A to G	E. coli	562	1	Nonsense suppressor. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). <i>Biochem. Cell Biol.</i> 73, 925-931.	570
571	16S	96080.1	1489		1411	HELIX	134696908	G to C	E. coli	562	1	Ribosome activity reduced. b Double mutant (G1491U/G1489C).	Hui, A. and DeBoer, H.A. (1987). <i>Proc. Natl. Acad. Sci U.S.A.</i> 84, 4762-4766.	571
572	16S	96080.1	1489		1411	HELIX	134696908	G to C	E. coli	562	1	Ribosome activity reduced. b Double mutant (G1489C/G1491U).	Hui, A. and DeBoer, H.A. (1987). <i>Proc. Natl. Acad. Sci U.S.A.</i> 84, 4762-4766.	572
573	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Suppressor of UGA nonsense mutation in trpA. b	Gregory, S.T. and Dahlberg, A.E. (1995) <i>Nucleic Acids Res.</i> 23, 4234-4238.	573
574	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	Paramomycin, neomycin, kanamycin, tobramycin, gentamycin, aparomycin, hygromycin. b Higher order structure rearrangement. c	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). <i>EMBO J.</i> 8, 1213-1216.	574
575	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Decreased binding to the paramomycin-coupled matrix. c	Blanchard S.C., Fourmy D, Eason R.G., Puglisi J.D. 1998. rRNA Chemical Groups Required for Aminoglycoside Binding. <i>Biochemistry</i> 37: 7716-7724.	575
576	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Ribosome activity reduced. b Double mutant (G1489C/G1491U).	Hui, A. and DeBoer, H.A. (1987). <i>Proc. Natl. Acad. Sci U.S.A.</i> 84, 4762-4766.	576
577	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Paramomycin, neomycin, kanamycin, tobramycin, gentamycin, aparomycin, hygromycin. b Higher order structure rearrangement. c	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). <i>EMBO J.</i> 8, 1213-1216.	577
578	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell Biol.</i> 73, 852-868.	578
579	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell Biol.</i> 73, 852-868.	579

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
580	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (C1409G/G1491C).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	580
581	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	No drug resistance. b Double mutant (C1409G/G1491C).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). <i>EMBO J.</i> 8, 1213-1216.	581
582	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	Slightly reduced interaction with Paromomycin. Double mutant (C1409G/G1491C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). <i>Nucleic Acids Research</i> 24, 3700-3706.	582
583	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (C1409U/G1491A).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	583
584	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	No drug resistance. Double mutant (C1409U/G1491A).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). <i>EMBO J.</i> 8, 1213-1216.	584
585	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	585
586	16S	96080.1	1491		1409	HELIX	134696908	G to U	Tetrahymena thermophila	5911		Paromomycin resistance in Tetrahymena thermophila.	Spangler, E.A. and Blackburn, E.A. (1985) <i>J. Biol. Chem.</i> 260: 6334-6340.	586
587	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Weakened interaction with Paromomycin.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). <i>Nucleic Acids Research</i> 24, 3700-3706.	587
588	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b Double mutant (G1491A/C1409A).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	588
589	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	No drug resistance. Double mutant (G1491A/C1409G).	DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). <i>EMBO J.</i> 8, 1213-1216.	589
590	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (G1491A/C1409U).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	590
591	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	Increased accuracy; small decreases in stop codon readthrough and frameshifting. b Double mutant (G1491C/C1409G).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	591

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592	16S	96080.1	1491		1409	HELIX	134696908	G to C	E. coli	562	1	No drug resistance. b Double mutant (G1491C/C1409G).	De Stasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	592
593	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Ribosome activity reduced. b Double mutant (G1491U/G1489C).	Hui, A. and DeBoer, H.A. (1987). Proc. Natl. Acad. Sci U.S.A. 84, 4762-4766.	593
594	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Ribosome activity reduced. b Double mutant (G1491U/C1409A).	1) Hui, A.S., Eaton, D.H., and DeBoer, H.A. (1988). EMBO J. 7, 4383-4388. 2) De Stasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	594
595	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Slightly reduced interaction with Paromomycin. Double mutant (C1409A/G1491U).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	595
596	16S	96080.1	1491		1409	HELIX	134696908	G to A	E. coli	562	1	Increased frameshifting and readthrough of nonsense codons. Double mutant (C1409A/G1491A).	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). Biochem. Cell. Biol. 73, 852-868.	596
597	16S	96080.1	1491		1409	HELIX	134696908	G to U	E. coli	562	1	Ribosome activity reduced. Double mutant (C1409A/G1491U).	1) Hui, A.S., Eaton, D.H., and DeBoer, H.A. (1988). EMBO J. 7, 4383-4388. 2) DeStasio, E.A., Moazed, D., Noller, H.F., and Dahlberg, A.E. (1989). EMBO J. 8, 1213-1216.	597
598	16S	96080.1	1492	a	0	INTERNAL	134700220	A to C	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis,, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	598
599	16S	96080.1	1492	a	0	INTERNAL	134700220	A to C	E. coli	562	1	No effect on Paromomycin binding. Double mutant (A1492C/A1493C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	599
600	16S	96080.1	1492	a	0	INTERNAL	134700220	A to G	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis,, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	600
601	16S	96080.1	1492	a	0	INTERNAL	134700220	A to U	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis,, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	601
602	16S	96080.1	1493		0	INTERNAL	134700220	A to C	E. coli	562	1	No effect on Paromomycin binding. Double mutant (A1492C/A1493C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	602

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
603	16S	96080.1	1493	a	0	INTERNAL	134700220	A to G	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	603
604	16S	96080.1	1493	a	0	INTERNAL	134700220	A to U	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	604
605	16S	96080.1	1493	a	0	INTERNAL	134700220	A to C	E. coli	562	1	Lethal; incorporated into polysomes. b	1) Santer, M., Davis, B., Solky, B., Zlotolow, D., Santer, U.V. (1995) Abstract 52. Frontiers in Translation, in press. 2) Santer, M. and Santer, U. (personal communication)	605
606	16S	96080.1	1493	a	0	INTERNAL	134700220	A to G	E. coli	562	1	Nonsense suppressor. b	Murgola, E.J., Pael, R.T., Hijazi, K.A., Arkov, A.L., Xu, W. and Zhao, S.Q. (1995). Biochem. Cell Biol. 73, 925-931.	606
607	16S	96080.1	1494		1407	HELIX	134696872	G to C	E. coli	562	1	Severely impaired Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	607
608	16S	96080.1	1494		1407	HELIX	134696872	G to A	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407U/G1494A).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	608
609	16S	96080.1	1494		1407	HELIX	134696872	G to C	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407G/G1494C).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	609
610	16S	96080.1	1494		1407	HELIX	134696872	G to G	E. coli	562	1	Severely impaired Paromomycin binding. Double mutant (C1407U/G1494G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	610
611	16S	96080.1	1495		0	INTERNAL	134700184	U to G	E. coli	562	1	No affect on Paromomycin binding. Double mutant (U1406G/U1495G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	611
612	16S	96080.1	1495		0	INTERNAL	134700184	U to C	E. coli	562	1	Greatly reduced affinity for Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	612
613	16S	96080.1	1495		0	INTERNAL	134700184	U to A	E. coli	562	1	Reduced affinity for the aminoglycoside paromomycin. a	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	613

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
614	16S	96080.1	1495		0	INTERNAL	134700184	U to G	E. coli	562	1	Reduced affinity for the aminoglycoside paromomycin. a	Retch M.I., Douthwaite S, Dahlquist K.D., Puglisi J.D. 1999. Effect of Mutations in the A site of 16S rRNA in Aminoglycoside Antibiotic-Ribosome Interaction. J. Mol. Biol. 286: 33-43.	614
615	16S	96080.1	1495		0	INTERNAL	134700184	U to A	E. coli	562	1	Greatly reduced affinity for Paromomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	615
616	16S	96080.1	1495		0	INTERNAL	134700184	U to G	E. coli	562	1	No effect on Paramomycin binding.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	616
617	16S	96080.1	1495		0	INTERNAL	134700184	U to G	E. coli	562	1	No effect on Paramomycin binding. Double mutant (U1495G/U1406G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	617
618	16S	96080.1	1496	a	1405	HELIX	134696836	C to G	E. coli	562	1	Inhibited tRNA binding. c	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	618
619	16S	96080.1	1496	a	1405	HELIX	134696836	C to G	E. coli	562	1	Significant reduction of paromomycin binding at positions 1405 and 1491. Slight reduction of Paromomycin binding at position 1494.	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	619
620	16S	96080.1	1496	a	1405	HELIX	134696836	C to G	E. coli	562	1	Restored tRNA binding. c Double mutant (C1496G/G1405C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	620
621	16S	96080.1	1496		1405	HELIX	134696836	C to G	E. coli	562	1	No affect on Paromomycin binding. Double mutant (G1405C/C1496G).	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	621
622	16S	96080.1	1496		1405	HELIX	134696836	C to G	E. coli	562	1	Restored tRNA binding. c Double mutant (G1405C/C1496G).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	622
623	16S	96080.1	1497		1404	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c Double mutant (G1405C/G1497C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). Biochemistry 32, 7172-7180.	623
624	16S	96080.1	1497	a	1404	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c	Miyaguchi, H., Narita, H., Sakamoto, K., and Yokoyama, S. (1996). Nucleic Acids Research 24, 3700-3706.	624
625	16S	96080.1	1497	a	1404	HELIX	134696836	G to C	E. coli	562	1	Restored tRNA binding. c Double mutant (G1497C/C1401G).	1) Jemiolo, D.K, Zwieb, C., and Dahlberg, A.E. (1985). Nucleic Acids Res. 13, 8631-8643. 2) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 3) Denman, R., Negre, D., Cunningham, P.R.,	625

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626	16S	96080.1	1497	a	1404	HELIX	134696836	G to C	E. coli	562	1	Inhibited tRNA binding. c Double mutant (G1497C/G1405C).	Cunningham, P.R., Nurse, K., Weitzmann, C.J., and Ofengand, J. (1993). <i>Biochemistry</i> 32, 7172-7180.	626
627	16S	96080.1	1498	a	0	INTERNAL	134700148	U to G	E. coli	562	1	U1498G strongly inhibited fMet-Val formation; A-site function impaired; enhanced tRNA fMet tRNA selectivity. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). <i>J. Mol. Biol.</i> 234, 14-27.	627
628	16S	96080.1	1498		0	INTERNAL	134700148	U to G	E. coli	562	1	No reaction to CMCT; some reactivity with kethoxal; enhanced reactivity of kethoxal in G 1405. c	Moine H, Nurse K, Ehresmann B, Ehresmann C, Ofengand J. 1997. Conformational Analysis of Escherichia coli 30S Ribosomes Containing the Single-Base Mutations G530U, U1498G, G1401C, and C1501G and the Double-Base Mutation G1401C/C1501G. <i>Biochemistry</i> 36: 137	628
629	16S	96080.1	1498	a	0	INTERNAL	134700148	U to C	E. coli	562	1	U1498G strongly inhibited fMet-Val formation; A-site function impaired; enhanced tRNA fMet tRNA selectivity. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). <i>J. Mol. Biol.</i> 234, 14-27.	629
630	16S	96080.1	1498	a	0	INTERNAL	134700148	U to A	E. coli	562	1	U1498G strongly inhibited fMet-Val formation; A-site function impaired; enhanced tRNA fMet tRNA selectivity. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). <i>J. Mol. Biol.</i> 234, 14-27.	630
631	16S	96080.1	1501		1401	HELIX	134696800	C to G	E. coli	562	1	Impaired A-site function; enhanced tRNA fMet selectivity. c Double mutant (G1401C/C1501G).	1) Cunningham, P.R., Nurse, K., Weitzmann, C.J., Negre, D., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 7629-7637. 2) Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Plumm, M., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 12012-12022. 3) Ringqu	631
632	16S	96080.1	1501		1401	HELIX	134696800	C to G	E. coli	562	1	Caused numerous increase of inactivity in 1400/1500 regions; guanine residue becomes highly reactive. c	Moine H, Nurse K, Ehresmann B, Ehresmann C, Ofengand J. 1997. Conformational Analysis of Escherichia coli 30S Ribosomes Containing the Single-Base Mutations G530U, U1498G, G1401C, and C1501G and the Double-Base Mutation G1401C/C1501G. <i>Biochemistry</i> 36: 137	632
633	16S	96080.1	1501	a	1401	HELIX	134696800	C to G	E. coli	562	1	Disrupted tRNA binding and polypeptide synthesis. c	1) Cunningham, P.R., Nurse, K., Weitzmann, C.J., Negre, D., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 7629-7637. 2) Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Plumm, M., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 12012-12022.	633

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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634	16S	96080.1	1501	a	1401	HELIX	134696800	C to G	E. coli	562	1	Impaired A-site function; enhanced tRNA fMet selectivity. c Double mutant (C1501G/G1401C).	1) Cunningham, P.R., Nurse, K., Weitzmann, C.J., Negre, D., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 7629-7637. 2) Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Plumm, M., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 12012-12022. 3) Ringgu	634
635	16S	96080.1	1505	a	0	FREE	134701228	G to A	E. coli	562	1	Suppresses ?C1400, C1395U, and C1470U. b,c	1) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). <i>Nucleic Acids Res.</i> 16, 8129-8146. 2) Zimmerman, R.A., Thomas, C.L., and Wower, J. (1990). <i>In The Ribosome: Structure, Function and Evolution</i> (W.E. Hill, A. Dahlberg, R.	635
636	16S	96080.1	1505	a	0	FREE	134701228	G to U	E. coli	562	1	Increased levels of stop codon readthrough and frameshifting. b	O'Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995). <i>Biochem. Cell. Biol.</i> 73, 852-868.	636
637	16S	96080.1	1505	a	0	FREE	134701228	G to U	E. coli	562	1	Slower growth rate than G791A alone. Double mutant (G1505U/G791A).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). <i>Nucleic Acids Research</i> 25, 1187-1193.	637
638	16S	96080.1	1505		0	FREE	134701228	G to U	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over C1407U alone. Double mutant (C1407U/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). <i>Nucleic Acids Research</i> 25, 1187-1193.	638
639	16S	96080.1	1505		0	FREE	134701228	G to U	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over [[Delta]]C1400 alone. Double mutant (? C1400/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). <i>Nucleic Acids Research</i> 25, 1187-1193.	639
640	16S	96080.1	1505		0	FREE	134701228	G to U	E. coli	562	1	Viable cells, suppresses lethality. Stimulates initiation from a non-AUG initiation codon. Increased growth rate over C1395U alone. Double mutant (C1395U/G1505U).	O'Connor, M., Thomas, C.L., Zimmermann, R.A., and Dahlberg, A.E. (1997). <i>Nucleic Acids Research</i> 25, 1187-1193.	640
641	16S	96080.1	1505	a	0	FREE	134701228	G to C	E. coli	562	1	Suppresses ?C1400, C1395U, and C1470U. b,c	1) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). <i>Nucleic Acids Res.</i> 16, 8129-8146. 2) Zimmerman, R.A., Thomas, C.L., and Wower, J. (1990). <i>In The Ribosome: Structure, Function and Evolution</i> (W.E. Hill, A. Dahlberg, R.	641

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
642	16S	96080.1	1505	a	0	FREE	134701228	G to U	E. coli	562	1	Suppresses ?C1400, C1395U, and C1470U. b,c	1) Thomas, C.L., Gregory, R.J., Winslow, G., Muto, A., and Zimmerman, R.A. (1988). Nucleic Acids Res. 16, 8129-8146. 2) Zimmerman, R.A., Thomas, C.L., and Wower, J. (1990). In The Ribosome: Structure, Function and Evolution (W.E. Hill, A. Dahlberg, R.	642
643	16S	96080.1	1512		1523	HELIX	134697088	U to C	E. coli	562	1	No effect on initiation complex formation.c Double mutant (C1524U/U1512C).	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). J. Mol. Biol. 234, 14-27.	643
644	16S	96080.1	1512	a	1523	HELIX	134697088	U to G	E. coli	562	1	U512G no effect on initiation complex formation; U512C enhanced tRNA fMet binding and selectivity. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). J. Mol. Biol. 234, 14-27.	644
645	16S	96080.1	1512	a	1523	HELIX	134697088	C to C	E. coli	562	1	No effect on initiation complex formation.c Double mutant (U1512C/C1524C).	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). J. Mol. Biol. 234, 14-27.	645
646	16S	96080.1	1512	a	1523	HELIX	134697088	U to C	E. coli	562	1	U512G no effect on initiation complex formation; U512C enhanced tRNA fMet binding and selectivity. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). J. Mol. Biol. 234, 14-27.	646
647	16S	96080.1	1512	a	1523	HELIX	134697088	U to C	E. coli	562	1	No effect on initiation complex formation.c Double mutant (U1512C/C1524C).	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). J. Mol. Biol. 234, 14-27.	647
648	16S	96080.1	1518		0	HAIRPIN	134700436	A to C	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022.	648
649	16S	96080.1	1518		0	HAIRPIN	134700436	A to G	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022.	649
650	16S	96080.1	1518		0	HAIRPIN	134700436	A to U	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022.	650
651	16S	96080.1	1519		0	HAIRPIN	134700436	A to G	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022.	651
652	16S	96080.1	1519		0	HAIRPIN	134700436	A to U	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). Biochemistry 31, 12012-12022.	652

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653	16S	96080.1	1519		0	HAIRPIN	134700436	A to C	E. coli	562	1	Little effect on ribosome assembly or function. (c)	Cunningham, P.R., Nurse, K., Bakin, A., Weitzmann, C.J., Pflumm, M., and Ofengand, J. (1992). <i>Biochemistry</i> 31, 12012-12022.	653
654	16S	96080.1	1523		1512	HELIX	134697088	G to A	E. coli	562	1	No effect on initiation complex formation. c	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). <i>J. Mol. Biol.</i> 234, 14-27.	654
655	16S	96080.1	1524		1511	HELIX	134697088	C to U	E. coli	562	1	No effect on initiation complex formation.c Double mutant (C1524U/U1512C).	Ringquist, S., Cunningham, P., Weitzmann, C., Formenoy, L., Pleij, C., Ofengand, J., and Gold, L. (1993). <i>J. Mol. Biol.</i> 234, 14-27.	655
656	16S	96080.1	1530	a	0	TAIL	134697160	G to A	E. coli	562	1	Lethal under high copy number expression. b Deficient initiation complex formation, subunit association, and IF3 binding. c Double mutant (G1530A/A1531G).	Firpo, M.A., Connelly, M.B., Goss, D.J. and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	656
657	16S	96080.1	1530		0	TAIL	134697160	G to A	E. coli	562	1	Lethal under high copy number expression. b Deficient initiation complex formation, subunit association, and IF3 binding. c Double mutant (A1531G/G1530A).	Firpo, M.A., Connelly, M.B., Goss, D.J. and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	657
658	16S	96080.1	1531		0	TAIL	134697160	A to G	E. coli	562	1	Lethal under high copy number expression. b Deficient initiation complex formation, subunit association, and IF3 binding. c Double mutant (G1530A/A1531G).	Firpo, M.A., Connelly, M.B., Goss, D.J. and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	658
659	16S	96080.1	1531	a	0	TAIL	134697160	A to G	E. coli	562	1	Lethal under high copy number expression. b Deficient initiation complex formation, subunit association, and IF3 binding. c Double mutant (A1531G/G1530A).	Firpo, M.A., Connelly, M.B., Goss, D.J. and Dahlberg, A.E. (1990). <i>Biochimica et Biophysica Acta</i> , 1050, 27-33.	659
660	16S	96080.1	1533		0	TAIL	134697160	C to A	E. coli	562	1	Slight reduction in tRNA binding. c	Ericson, G., Minchew, P. and Wollenzien, P. (1995). <i>J. Mol. Biol.</i> 250, 407-419.	660
661	16S	96080.1	1538		0	TAIL	134697160	C to U	E. coli	562	1	Dominant lethal under natural promoter; decreased complementarity to Shine-Delgarno region produces lower level protein synthesis. b	Jacob, W.F., Santer, M., and Dahlberg, A.E. (1987). <i>Proc. Natl. Acad. Sci. U.S.A.</i> 84, 4757-4761.	661
662	23S	96092.1	1698		0	INTERNAL	134735128	A to G	E. coli	562	1	Suppresses 2555 mutations	O'Connor and Dahlberg, unpublished.	662
663	23S	96092.1	1819		0	BULGE	134735416	A to G	E. coli	562	1	Suppresses 2555 mutations	O'Connor and Dahlberg, unpublished.	663
664	23S	96092.1	1914		0	HAIRPIN	134735704	C to A	E. coli	562	1	Little or no effect on translational fidelity.	O'Connor and Dahlberg, unpublished.	664
665	23S	96092.1	1914		0	HAIRPIN	134735704	C to U	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor	O'Connor, M., Brunelli, C. A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995) <i>Biochem. Cell Biology</i> 73, 859-868.	665
666	23S	96092.1	1916		0	HAIRPIN	134735704	del A	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor	O'Connor, M., Brunelli, C. A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I. and Dahlberg, A.E. (1995) <i>Biochem. Cell Biology</i> 73, 859-868.	666
667	23S	96092.1	1921		1909	HELIX	134729296	G to C	E. coli	562	1	Little or no effect on translational fidelity.	O'Connor and Dahlberg, unpublished.	667

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668	23S	96092.1	1926		0	HAIRPIN	134735740	U to C	E. coli	562	1	Reduced 70S ribosome formation in vivo; reduced peptidyl transferase activity in 50S subunits.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	668
669	23S	96092.1	1940		0	BULGE	134735776	U to A	E. coli	562	1	Slightly reduced 70S ribosome formation in vivo; slightly reduced peptidyl transferase activity in 50S subunits.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	669
670	23S	96092.1	1946		1960	HELIX	134729404	U to C	E. coli	562	1	Low level 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits not detected.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	670
671	23S	96092.1	1951		0	HAIRPIN	134735812	U to C	E. coli	562	1	Normal 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits normal.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	671
672	23S	96092.1	1955		0	HAIRPIN	134735812	U to G	E. coli	562	1	Low level 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits normal.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	672
673	23S	96092.1	1956		1950	HELIX	134729404	U to A	E. coli	562	1	Low level 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits normal. low; normal	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	673
674	23S	96092.1	1979		1772	HELIX	134728792	U to C	E. coli	562	1	Slightly reduced 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits not detected.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	674
675	23S	96092.1	1982		1770	HELIX	134728756	U to A	E. coli	562	1	70S ribosome formation in vivo not detected; peptidyl transferase activity in 50S subunits not detected.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	675
676	23S	96092.1	1984		1768	HELIX	134728756	G to A	E. coli	562	1	low 70S ribosome formation in vivo; peptidyl transferase activity in 50S subunits not detected.	Leviev, I., Levieva, S. and Garrett, R.A. (1995) Nucleic Acids. Res. 23, 1512-1517.	676
677	23S	96092.1	2017		1262	HELIX	134727352	U to G	E. coli	562	1	Reduced growth rate on erythromycin.	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	677
678	23S	96092.1	2017		1262	HELIX	134727352	U to C	E. coli	562	1	Reduced growth rate of erythromycin.	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	678
679	23S	96092.1	2017		1262	HELIX	134727352	U to A	E. coli	562	1	Reduced growth rate of erythromycin.	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	679
680	23S	96092.1	2017		1262	HELIX	134727352	U to A	E. coli	562	1	Suppression of growth effects; wild-type growth on erythromycin. Double mutation (U2017A/A1262U)	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	680
681	23S	96092.1	2017		1262	HELIX	134727352	U to C	E. coli	562	1	Reduced growth rate on erythromycin. Double mutation (U2017C/A1262G)	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	681
682	23S	96092.1	2017		1262	HELIX	134727352	U to G	E. coli	562	1	Reduced growth rate on erythromycin. Double mutation (U2017G/A1262C)	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	682
683	23S	96092.1	2017		1262	HELIX	134727352	U to G	E. coli	562	1	Reduced growth rate on erythromycin. Double mutation (U2017G/A1262U)	Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993.	683
684	23S	96092.1	2026		2037	HELIX	134729440	U to C	E. coli	562	1	Suppresses 2555 mutations.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	684
685	23S	96092.1	2032		0	HAIRPIN	134735884	G to C	E. coli	562	1	Eryhs, Cdr, Cmr; no effect on methylation.	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	685

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
686	23S	96092.1	2032		0	HAIRPIN	134735884	G to A	E. coli	562	1	Eryhs, Cdr, Cmr; no effect on methylation.	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	686
687	23S	96092.1	2032		0	HAIRPIN	134735884	C to U	E. coli	562	1	Eryhs, Cdr, Cmr; no effect on methylation.	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	687
688	23S	96092.1	2032		0	HAIRPIN	134735884	G to A	Tobacco chloroplasts	-	2	Lincomycin resistance.	CsepĀĀ, A., Etzold, T., Schell, J., and Schreier, P.H. (1988) Mol. Genet. 214, 295-299.	688
689	23S	96092.1	2032		0	HAIRPIN	134735884	G to A	E. coli	562	1	EryS, Cds, Cms. Double mutation (G2032A/A2058G)	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	689
690	23S	96092.1	2032		0	HAIRPIN	134735884	G to A	E. coli	562	1	Eryhs, Cds, Cms. Double mutation (G2032A/A2058U).	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	690
691	23S	96092.1	2032		0	HAIRPIN	134735884	G to A	E. coli	562	1	Eryr, Cdr, Cmr. Double mutation (G2032A/G2057A).	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	691
692	23S	96092.1	2032		0	HAIRPIN	134735884	AG to GA	Helicobacter pylori	210	1	Clr/Azm/Ery-R	HĀĀten, K., A. GĀbreel, O. SkĀĀĀld, and L. Engstrand. 1997. Macrolide resistance in Helicobacter pylori: mechanism and stability in strains from clarithromycin-treated patients. Antimicrob. Agents Chemother. 41:2550-2553.	692
693	23S	96092.1	2051		0	BULGE	134735920	del A	E. coli	562	1	Prevents ErmE methylation. c	Vester B, Nielsen AK, Hansen LH, Douthwaite S. 1998. ErmE Methyltransferase Recognition Elements in RNA Substrates. J. Mol. Biol. 282: 255-264.	693
694	23S	96092.1	2052		2617	HELIX	134729512	A to C	E. coli	562	1	Prevents ErmE methylation. c	Vester B, Nielsen AK, Hansen LH, Douthwaite S. 1998. ErmE Methyltransferase Recognition Elements in RNA Substrates. J. Mol. Biol. 282: 255-264.	694
Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
695	23S	96092.1	2052		2617	HELIX	134729512	A to G	E. coli	562	1	Like A2052C. c	Vester B, Nielsen AK, Hansen LH, Douthwaite S. 1998. ErmE Methyltransferase Recognition Elements in RNA Substrates. J. Mol. Biol. 282: 255-264.	695
696	23S	96092.1	2052		2617	HELIX	134729512	A to U	E. coli	562	1	Like A2052C. c	Vester B, Nielsen AK, Hansen LH, Douthwaite S. 1998. ErmE Methyltransferase Recognition Elements in RNA Substrates. J. Mol. Biol. 282: 255-264.	696
697	23S	96092.1	2057		2611	HELIX	134729548	G to A	Chlamydomonas reinhardtii chl.	3055	2	Ery-R, Lin-S	Harris, E. H., B. D. Burkhart, N. W. Gillham, and J. E. Boynton. (1989) Genetics. Antibiotic resistance mutations in the chloroplast 16S and 23S rRNA genes of Chlamydomonas reinhardtii: correlation of genetic and physical maps of the chloroplast genome.	697
698	23S	96092.1	2057		2611	HELIX	134729548	G to A	Escherichia coli	562	1	Ery-R, M16-S, SBa□□S	Ettayebi, M., S. M. Prasad, and E. A. Morgan. 1985. Chloramphenicol-erythromycin resistance mutations in a 23S rRNA gene of Escherichia coli. J. Bacteriol. 162:551-557.	698
699	23S	96092.1	2057		2611	HELIX	134729548	G to A	Propionibacteria	1743	1	Ery-LR, M16-S	Ross, J. I., E. A. Eady, J. H. Cove, C. E. Jones, A. H. Ratyal, Y. W. Miller, S. Vyakrnam, and W. J. Cunliffe. 1997. Clinical resistance to erythromycin and clindamycin in cutaneous propionibacteria isolated from acne patients is associated with mutations	699
700	23S	96092.1	2057		2611	HELIX	134729548	GG to AA	Escherichia coli	562	1	Ery-R, Lin-R	Douthwaite, S. 1992. Functional interactions within 23S rRNA involving the peptidyltransferase center. J. Bacteriol. 174:1333-1338.	700
701	23S	96092.1	2057		2611	HELIX	134729548	G to A	E. coli	562	1	Eryr, Clinidamycin (Cd)s, Chloramphenicol (Cm)r; reduces methylation of 23S rRNA by ErmE.	1. Ettayebi, M., Prasad, S.M., and Morgan, E.A. (1985) J. Bacteriol. 162, 551-557 2. Aagard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	701
702	23S	96092.1	2057		2611	HELIX	134729548	G to A	Chlamydomonas reinhardtii	3055		Eryr.	Harris, E.H., Burkhart, B.D., Gilham, N.W., and Boynton, J.E. (1989) Genetics 123, 281-292.	702
703	23S	96092.1	2057		2611	HELIX	134729548	G to A	E. coli	562	1	Slightly Eryr; reduced methylation. Double mutation (G2057A/C2661U).	Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	703

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704	23S	96092.1	2057		2611	HELIX	134729548	G to A	E. coli	562	1	Eryr, Cdr, Cmr. Double mutation (G2057A/G2032A).	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	704
705	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Chlamydomonas reinhardtii	3055		Eryr, Lincomycin and clindamycin resistance.	Harris, E.H., Burkhart, B.D., Gilham, N.W., and Boynton, J.E. (1989) Genetics 123, 281-292.	705
706	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Clarithromycin resistance	Versalovic, J., Shortridge, D., Kibler, K., Griffy, M.V., Beyer, J., Flamm, R.K., Tenaka, S.K., Graham, D.Y., and Go, M.F. (1996) Antimicrob. Agents Chemother. 40, 477-480.	706
707	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	E. coli	562	1	Eryr, Cdr, Cms; abolishes methylation of 23S rRNA by ErmE.	1. Vester, B. and Garrett, R.A. (1988) EMBO J. 7, 3577-3587. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	707
708	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Yeast mitochondria	4932	3	Erythromycin resistance.	Sor, F. and Fukuhara, H. (1982) Nucleic Acids Res. 10, 6571-6577.	708
709	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Solanum nigrum	4112		Lincomycin resistance.	Kavanagh, T.A., O'Connell, D., K.M., McCabe, P.F., and Dix, P.J. (1994) Mol. Gen. Genet. 242, 675-680.	709
710	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Tobacco chloroplasts	-	2	Lincomycin resistance.	Csepil, A., Etzold, T., Schell, J., and Schreiber, P.H. (1988) Mol. Genet. 214, 295-299.	710
711	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	E. coli	562	1	EryS, Cds, Cms. Double mutation (A2058G/G2032A).	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	711
712	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	E. coli	562	1	Eryhs, Cds, Cms. Double mutation (A2058U/G2032A).	1. Douthwaite, S. (1992) J. Bacteriol. 174, 1333-1338. 2. Aagaard, C. and Douthwaite, S. (1994) Proc. Natl. Acad. Sci. USA 91, 2989-2993. 3. Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509.	712
713	23S	96092.1	2058		0	MULTISTEM	134738620	A to G/U	Brachyspira hyodysenteriae	159	1	Ery-R, Tyl-R, Lin-R	Karlsson, M., C. Fellstrom, M. U. Heldtander, K. E. Johansson, and A. Franklin. 1999. Genetic basis of macrolide and lincosamide resistance in Brachyspira (Serpulina) hyodysenteriae. FEMS Microbiol. Lett. 172:255-260.	713

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714	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Chlamydomonas reinhardtii chl.	3055	2	Ery-R, Lin-R	Harris, E. H., B. D. Burkhardt, N. W. Gillham, and J. E. Boynton. (1989). Genetics. Antibiotic resistance mutations in the chloroplast 16S and 23S rRNA genes of Chlamydomonas reinhardtii: correlation of genetic and physical maps of the chloroplast genome.	714
715	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Escherichia coli	562	1	Ery-R, Lin-R	1) Douthwaite, S. 1992. Functional interactions within 23S rRNA involving the peptidyltransferase center. J. Bacteriol. 174:1333-1338. 2) Vester, B., and R. A. Garrett. Biochimie, 69 (1987) 891-900. A plasmid-coded and site-directed mutation in Escherichia coli.	715
716	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	Escherichia coli	562	1	MLSB-R	Sigmund, C. D., M. Ettayebi, and E. A. Morgan. 1984. Antibiotic resistance mutations in 16S and 23S ribosomal RNA genes of Escherichia coli. Nucl Acids Res. 12:4653-4663.	716
717	23S	96092.1	2058		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	Clr-R	Stone, G. G., D. Shortridge, R. K. Flamm, J. Versalovic, J. Beyer, K. Idler, L. Zulawinski, and S. K. Tanaka. 1996. Identification of a 23S rRNA gene mutation in clarithromycin-resistant Helicobacter pylori. Helicobacter. 1:227-228.	717
718	23S	96092.1	2058		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	Mac-R, Lin-R	Occhialini, A., M. Urdaci, F. Doucet-Populaire, C. M. BÄ@bÄ@ar, H. Lamouliatte, and F. MÄ@graud. 1997. Macrolide resistance in Helicobacter pylori: rapid detection of point mutations and assays of macrolide binding to ribosomes. Antimicrob. Agents Chemother	718
719	23S	96092.1	2058		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	MLSB -R	Wang, G., and D. E. Taylor. 1998. Site-specific mutations in the 23S rRNA gene of Helicobacter pylori confer two types of resistance to macrolide-lincosamide-streptogramin B antibiotics. Antimicrob. Agents Chemother. 42:1952-1958.	719
720	23S	96092.1	2058		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	Cla-R	Debets-Ossenkopp, Y. J., A. B. Brinkman, E. J. Kuipers, C. M. Vandenbroucke-Grauls, and J. G. Kusters. 1998. Explaining the bias in the 23S rRNA gene mutations associated with clarithromycin resistance in clinical isolates of Helicobacter pylori. Antimicrob	720
Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
721	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Cla-R	Versalovic, J., D. Shortridge, K. Kibler, M. V. Griffy, J. Beyer, R. K. Flamm, S. K. Tanaka, D. Y. Graham, and M. F. Go. 1996. Mutations in 23S rRNA are associated with clarithromycin resistance in Helicobacter pylori. Antimicrob. Agents Chemother. 40:4	721
722	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Mac-R, Lin-R	Occhialini, A., M. Urdaci, F. Doucet-Populaire, C. M. BA@bA@ar, H. Lamouliatte, and F. MA@graud. 1997. Macrolide resistance in Helicobacter pylori: rapid detection of point mutations and assays of macrolide binding to ribosomes. Antimicrob. Agents Chemother	722
723	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	MLSB -R	Wang, G., and D. E. Taylor. 1998. Site-specific mutations in the 23S rRNA gene of Helicobacter pylori confer two types of resistance to macrolide-lincosamide-streptogramin B antibiotics. Antimicrob. Agents Chemother. 42:1952-1958.	723
724	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Cla-R	Debets-Ossenkopp, Y. J., A. B. Brinkman, E. J. Kuipers, C. M. Vandenbroucke-Grauls, and J. G. Kusters. 1998. Explaining the bias in the 23S rRNA gene mutations associated with clarithromycin resistance in clinical isolates of Helicobacter pylori. Antimicrob	724
725	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	Helicobacter pylori	210	1	MLSB -R	Wang, G., and D. E. Taylor. 1998. Site-specific mutations in the 23S rRNA gene of Helicobacter pylori confer two types of resistance to macrolide-lincosamide-streptogramin B antibiotics. Antimicrob. Agents Chemother. 42:1952-1958.	725
726	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	Helicobacter pylori	210	1	Cla-R	Debets-Ossenkopp, Y. J., A. B. Brinkman, E. J. Kuipers, C. M. Vandenbroucke-Grauls, and J. G. Kusters. 1998. Explaining the bias in the 23S rRNA gene mutations associated with clarithromycin resistance in clinical isolates of Helicobacter pylori. Antimicrob	726

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
727	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Mycobacterium abscessus	36809	1	Clr-R	Wallace, R. J., Jr., A. Meier, B. A. Brown, Y. Zhang, P. Sander, G. O. Onyi, and E. C. Böttger. 1996. Genetic basis for clarithromycin resistance among isolates of Mycobacterium chelonae and Mycobacterium abscessus. Antimicrob. Agents Chemother. 40:1676	727
728	23S	96092.1	2058		0	MULTISTEM	134738620	A to C/G/U	Mycobacterium avium	1764	1	Clr-R	Nash, K. A., and C. B. Inderlied. 1995. Genetic basis of macrolide resistance in Mycobacterium avium isolated from patients with disseminated disease. Antimicrob. Agents Chemother. 39:2625-2630.	728
729	23S	96092.1	2058		0	MULTISTEM	134738620	A to C/G	Mycobacterium chelonae	1774	1	Clr-R	Wallace, R. J., Jr., A. Meier, B. A. Brown, Y. Zhang, P. Sander, G. O. Onyi, and E. C. Böttger. 1996. Genetic basis for clarithromycin resistance among isolates of Mycobacterium chelonae and Mycobacterium abscessus. Antimicrob. Agents Chemother. 40:1676	729
730	23S	96092.1	2058		0	MULTISTEM	134738620	A to C/G/U	Mycobacterium intracellulare	1767	1	Clr-R	Meier, A., P. Kirschner, B. Springer, V. A. Steingrube, B. A. Brown, R. J. Wallace, Jr., and E. C. Böttger. 1994. Identification of mutations in 23S rRNA gene of clarithromycin-resistant Mycobacterium intracellulare. Antimicrob. Agents Chemother. 38:38	730
731	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	Mycobacterium kansasii	1768	1	Clr-R	Burman, W. J., B. L. Stone, B. A. Brown, R. J. Wallace, Jr., and E. C. Böttger. 1998. AIDS-related Mycobacterium kansasii infection with initial resistance to clarithromycin. Diagn. Microbiol. Infect. Dis. 31:369-371.	731
732	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Mycobacterium smegmatis	1772	1	Clr-R	Sander, P., T. Prammananan, A. Meier, K. Frischkorn, and E. C. Böttger. 1997. The role of ribosomal RNAs in macrolide resistance. Mol. Microbiol. 26:469-480.	732
733	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Mycoplasma pneumoniae	2104	1	Ery-HR, Spi-MR, Tyl-S, Lin-HR	Lucier, T. S., K. Heitzman, S. K. Liu, and P. C. Hu. 1995. Transition mutations in the 23S rRNA of erythromycin-resistant isolates of Mycoplasma pneumoniae. Antimicrob. Agents Chemother. 39:2770-2773.	733

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
734	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Propionibacteria	1743	1	MLSB -R	Ross, J. I., E. A. Eady, J. H. Cove, C. E. Jones, A. H. Ratyal, Y. W. Miller, S. Vyakrnam, and W. J. Cunliffe. 1997. Clinical resistance to erythromycin and clindamycin in cutaneous propionibacteria isolated from acne patients is associated with mutations	734
735	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Streptococcus pneumoniae	1313	1	MLSB -R	Tait-Kamradt, A., T. Davies, M. Cronan, M. R. Jacobs, P. C. Appelbaum, and J. Sutcliffe. 2000. Mutations in 23S rRNA and L4 ribosomal protein account for resistance in Pneumococcal strains selected in vitro by macrolide passage. Antimicrobial Agents and C	735
736	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Streptomyces ambifaciens	1889	1	MLSB -R	Pernodet, J. L., F. Boccard, M. T. Alegre, M. H. Blondelet-Rouault, and M. GuÃ©rineau. 1988. Resistance to macrolides, lincosamides and streptogramin type B antibiotics due to a mutation in an rRNA operon of Streptomyces ambifaciens. EMBO J. 7:277-282.	736
737	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Saccharomyces cerevisiae mit.	4932	3	Ery-R	Sor, F., and H. Fukuhara. 1982. Identification of two erythromycin resistance mutations in the mitochondrial gene coding for the large ribosomal RNA in yeast. Nucleic Acids Res. 10:6571-6577.	737
738	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	Treponema pallidum	160	1	Ery-R	Stamm, L. V., and H. L. Bergen. 2000. A point mutation associated with bacterial macrolide resistance is present in both 23S rRNA genes of an erythromycin-resistant Treponema pallidum clinical isolate [letter]. Antimicrob Agents Chemother. 44:806-807.	738
739	23S	96092.1	2058		0	MULTISTEM	134738620	A to C	E. coli	562	1	Confers resistance to the MLS drugs and chloramphenicol.	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	739
740	23S	96092.1	2058		0	MULTISTEM	134738620	A to G	E. coli	562	1	Like A2058C	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	740

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741	23S	96092.1	2058		0	MULTISTEM	134738620	A to U	E. coli	562	1	Like A2058C	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. <i>Molecular Microbiology</i> 31 (2): 623-631.	741
742	23S	96092.1	2059		0	MULTISTEM	134738620	A to C	E. coli	562	1	Conferred resistance to the MLS drugs and chloramphenicol.	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. <i>Molecular Microbiology</i> 31 (2): 623-631.	742
743	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	E. coli	562	1	Like A2059C	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. <i>Molecular Microbiology</i> 31 (2): 623-631.	743
744	23S	96092.1	2059		0	MULTISTEM	134738620	A to U	E. coli	562	1	Like A2059C	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-ketolide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. <i>Molecular Microbiology</i> 31 (2): 623-631.	744
745	23S	96092.1	2059		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	Mac-R, Lin-R, SB-S	Wang, G., and D. E. Taylor. 1998. Site-specific mutations in the 23S rRNA gene of Helicobacter pylori confer two types of resistance to macrolide-lincosamide-streptogramin B antibiotics. <i>Antimicrob. Agents Chemother.</i> 42:1952-1958.	745
746	23S	96092.1	2059		0	MULTISTEM	134738620	A to C	Helicobacter pylori	210	1	Clr-R	Debets-Ossenkopp, Y. J., A. B. Brinkman, E. J. Kuipers, C. M. Vandenbroucke-Grauls, and J. G. Kusters. 1998. Explaining the bias in the 23S rRNA gene mutations associated with clarithromycin resistance in clinical isolates of Helicobacter pylori. <i>Antimicrob. Agents Chemother.</i> 42:1952-1958.	746
747	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Clr-R	Versalovic, J., D. Shortridge, K. Kibler, M. V. Griffy, J. Beyer, R. K. Flamm, S. K. Tanaka, D. Y. Graham, and M. F. Go. 1996. Mutations in 23S rRNA are associated with clarithromycin resistance in Helicobacter pylori. <i>Antimicrob. Agents Chemother.</i> 40:4	747

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748	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Mac-R, Lin-R	Occhialini, A., M. Urdaci, F. Doucet-Populaire, C. M. B��ar, H. Lamouillat, and F. M��raud. 1997. Macrolide resistance in Helicobacter pylori: rapid detection of point mutations and assays of macrolide binding to ribosomes. Antimicrob. Agents Chemoth	748
749	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Mac-R, Lin-R, SB����	Wang, G., and D. E. Taylor. 1998. Site-specific mutations in the 23S rRNA gene of Helicobacter pylori confer two types of resistance to macrolide-lincosamide-streptogramin B antibiotics. Antimicrob. Agents Chemother. 42:1952-1958.	749
750	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Cla-R	Debets-Ossenkopp, Y. J., A. B. Brinkman, E. J. Kuipers, C. M. Vandenbroucke-Grauls, and J. G. Kusters. 1998. Explaining the bias in the 23S rRNA gene mutations associated with clarithromycin resistance in clinical isolates of Helicobacter pylori. Antimicr	750
751	23S	96092.1	2059		0	MULTISTEM	134738620	A to C/G	Mycobacterium abscessus	36809	1	Clr-R	Wallace, R. J., Jr., A. Meier, B. A. Brown, Y. Zhang, P. Sander, G. O. Onyi, and E. C. B��ttger. 1996. Genetic basis for clarithromycin resistance among isolates of Mycobacterium chelonae and Mycobacterium abscessus. Antimicrob. Agents Chemother. 40:1676	751
752	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Mycobacterium chelonae	1774	1	Clr-R	Wallace, R. J., Jr., A. Meier, B. A. Brown, Y. Zhang, P. Sander, G. O. Onyi, and E. C. B��ttger. 1996. Genetic basis for clarithromycin resistance among isolates of Mycobacterium chelonae and Mycobacterium abscessus. Antimicrob. Agents Chemother. 40:1676	752
753	23S	96092.1	2059		0	MULTISTEM	134738620	A to C	Mycobacterium intracellulare	1767	1	Clr/Azm-R	Meier, A., P. Kirschner, B. Springer, V. A. Steingrube, B. A. Brown, R. J. Wallace, Jr., and E. C. B��ttger. 1994. Identification of mutations in 23S rRNA gene of clarithromycin-resistant Mycobacterium intracellulare. Antimicrob. Agents Chemother. 38:38	753

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754	23S	96092.1	2059		0	MULTISTEM	134738620	A to C	Mycobacterium avium	1764	1	Clr/Azm-R	Meier, A., P. Kirschner, B. Springer, V. A. Steingrube, B. A. Brown, R. J. Wallace, Jr., and E. C. Böttger. 1994. Identification of mutations in 23S rRNA gene of clarithromycin-resistant Mycobacterium intracellulare. Antimicrob. Agents Chemother. 38:38	754
755	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Mycobacterium smegmatis	1772	1	Clr-R	Sander, P., T. Prammananan, A. Meier, K. Frischkorn, and E. C. Böttger. 1997. The role of ribosomal RNAs in macrolide resistance. Mol. Microbiol. 26:469-480.	755
756	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Mycoplasma pneumoniae	2104	1	Ery-MR, Spi-HR, Tyl-LR, Lin-MR	Lucier, T. S., K. Heitzman, S. K. Liu, and P. C. Hu. 1995. Transition mutations in the 23S rRNA of erythromycin-resistant isolates of Mycoplasma pneumoniae. Antimicrob. Agents Chemother. 39:2770-2773.	756
757	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Streptococcus pneumoniae	1313	1	Mac-R	Tait-Kamradt, A., T. Davies, M. Cronan, M. R. Jacobs, P. C. Appelbaum, and J. Sutcliffe. 2000. Mutations in 23S rRNA and L4 ribosomal protein account for resistance in Pneumococcal strains selected in vitro by macrolide passage. Antimicrobial Agents and	757
758	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Propionibacteria	1743	1	Mac-HR, Lin-LR	Ross, J. I., E. A. Eady, J. H. Cove, C. E. Jones, A. H. Ratyal, Y. W. Miller, S. Vyakarnam, and W. J. Cunliffe. 1997. Clinical resistance to erythromycin and clindamycin in cutaneous propionibacteria isolated from acne patients is associated with mutations	758
759	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Helicobacter pylori	210	1	Clarithromycin resistance.	Versalovic, J., Shortridge, D., Kibler, K., Griffy, M.V., Beyer, J., Flamm, R.K., Tanaka, S.K., Graham, D.Y., and Go, M.F. (1996) Antimicrob. Agents and Chemother. 40, 477-480.	759
760	23S	96092.1	2059		0	MULTISTEM	134738620	A to G	Tobacco chloroplasts	-	2	Lincomycin resistance.	Csepil, A., Etzold, T., Schell, J., and Schreier, P.H. (1988) Mol. Genet. 214, 295-299.	760
761	23S	96092.1	2060		0	MULTISTEM	134738620	A to C	E. coli	562	1		Vester, B. and Garrett, R.A. (1988) EMBO J. 7, 3577-3587.	761
762	23S	96092.1	2061		0	MULTISTEM	134738620	G to A	Rat mitochondria	10116	3	Chloramphenicol resistance	Vester, B. and Garrett, R.A. (1988) EMBO J. 7, 3577-3587.	762
763	23S	96092.1	2062		0	MULTISTEM	134738620	A to C	Halobacterium halobium	2242	1	Chloramphenicol resistance.	Mankin, A.S. and Garrett, R.A. (1991) J. Bacteriol. 173, 3559-3563.	763

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764	23S	96092.1	2123		2175	HELIX	134729908	G to C	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutations (G2123C/G2124C).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	764
765	23S	96092.1	2124		2174	HELIX	134729908	G to C	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutation (G2124C/G2123C).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	765
766	23S	96092.1	2125		0	MULTISTEM	134738728	G to A	E. coli	562	1	Reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	766
767	23S	96092.1	2125		0	MULTISTEM	134738728	G to C	E. coli	562	1	Reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	767
768	23S	96092.1	2125		0	MULTISTEM	134738728	G to U	E. coli	562	1	Reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	768
769	23S	96092.1	2125		0	MULTISTEM	134738728	G to U	E. coli	562	1	Slightly reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	769
770	23S	96092.1	2125		0	MULTISTEM	134738728	G to U	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutations (G2125U/A2126C).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	770
771	23S	96092.1	2126		0	MULTISTEM	134738728	A to C	E. coli	562	1	Reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	771
772	23S	96092.1	2126		0	MULTISTEM	134738728	A to G	E. coli	562	1	Reduced L1 binding in RNA fragments. a b	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	772
773	23S	96092.1	2126		0	MULTISTEM	134738728	A to C	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutations (A2126C/G2125U).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	773
774	23S	96092.1	2174		2124	HELIX	134729908	C to G	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutations (C2174G/C2175G).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	774
775	23S	96092.1	2175		2123	HELIX	134729908	C to G	E. coli	562	1	Reduced L1 binding in RNA fragments. a b Double mutations (C2175G/C2174G).	Said, B., Cole, J.R., and Nomura, M. (1988) Nucleic Acids Res. 16, 10529-10545.	775
776	23S	96092.1	2249		2255	HELIX	134730088	U to C	E. coli	562	1	Normal growth.	1. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32849-32856. 2. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32857-32862.	776
777	23S	96092.1	2250		0	HAIRPIN	134736208	G to A	E. coli	562	1	Normal growth.	1. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32849-32856. 2. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32857-32862.	777
778	23S	96092.1	2250		0	HAIRPIN	134736208	G to A	E. coli	562	1	Normal growth. Double mutations (G2250A/C2254U).	1. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32849-32856. 2. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32857-32862.	778

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779	23S	96092.1	2251		0	HAIRPIN	134736208	G to A	E. coli	562	1	Dominant lethal; Abolished both binding of tRNA and peptidyl transferase activity.	Green, R., Samaha, R., and Noller, H. (1997). J. Mol. Biol. 266, 40-50.	779
780	23S	96092.1	2251		0	HAIRPIN	134736208	G to A	E. coli	562	1	Dominant lethal; subunit association defect.	Gregory, S.T. and Dahlberg, A.E. (unpublished).	780
781	23S	96092.1	2251		0	HAIRPIN	134736208	G to C	E. coli	562	1	Dominant lethal subunit association defect.	Gregory, S.T. and Dahlberg, A.E. (unpublished).	781
782	23S	96092.1	2251		0	HAIRPIN	134736208	G to U	E. coli	562	1	Dominant lethal subunit association defect.	Gregory, S.T. and Dahlberg, A.E. (unpublished).	782
783	23S	96092.1	2251		0	HAIRPIN	134736208	G to U	E. coli	562	1	Dominant lethal; Abolished both binding of tRNA and peptidyl transferase activity.	Green, R., Samaha, R., and Noller, H. (1997). J. Mol. Biol. 266, 40-50.	783
784	23S	96092.1	2251		0	HAIRPIN	134736208	G to A	E. coli	562	1	Dominant lethal; impairs peptidyl transferase activity; induces DMS reactivity; induces kethoxal reactivity in G2238, G2409, G2410, G2529, and G2532; enhances CMCT reactivity in G2238; induces kethoxal and CMCT reactivity in G2269 and G2271; induces CMCT	Gregory ST, Dahlberg AE, 1999. Mutations in the Conserved P Loop Perturb the Conformation of Two Structural Elements in the Peptidyl Transferase Center of 23 S Ribosomal RNA. J. Mol. Biol. 285: 1475- 1483.	784
785	23S	96092.1	2252		0	HAIRPIN	134736208	G to A	E. coli	562	1	Dominant lethal; impairs peptidyl transferase activity; induces DMS reactivity; induces kethoxal reactivity in G2238, G2409, G2410, G2529, and G2532; enhances CMCT reactivity in G2238; induces kethoxal and CMCT reactivity in G2269 and G2271; induces CMCT	Gregory ST, Dahlberg AE, 1999. Mutations in the Conserved P Loop Perturb the Conformation of Two Structural Elements in the Peptidyl Transferase Center of 23 S Ribosomal RNA. J. Mol. Biol. 285: 1475- 1483.	785
786	23S	96092.1	2252		0	HAIRPIN	134736208	G to A	E. coli	562	1	Interfere with the building of peptidyl-tRNA to P site of 50S subunit.	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	786
787	23S	96092.1	2252		0	HAIRPIN	134736208	G to C	E. coli	562	1	Interferes with the binding of peptidyl-tRNA to P site of 50S subunit	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	787
788	23S	96092.1	2252		0	HAIRPIN	134736208	G to U	E. coli	562	1	Interferes with the binding of peptidyl-tRNA to P site of 50S subunit	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	788
789	23S	96092.1	2252		0	HAIRPIN	134736208	G to U	E. coli	562	1	Dominant lethal; suppressed AcPhe-Phe formation; suppressed peptide bond formation. c	Nitta I, Ueda T, Watanabe K. 1998. Possible involvement of Escherichia coli 23S ribosomal RNA in peptide bond formation. RNA 4: 257-267.	789
790	23S	96092.1	2252		0	HAIRPIN	134736208	G to A	E. coli	562	1	Less than 5% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	790
791	23S	96092.1	2252		0	HAIRPIN	134736208	G to C	E. coli	562	1	Less than 5% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	791
792	23S	96092.1	2252		0	HAIRPIN	134736208	G to U	E. coli	562	1	Less than 5% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	792

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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793	23S	96092.1	2252		0	HAIRPIN	134736208	G to U	E. coli	562	1	No effect on growth rate.	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine	793
794	23S	96092.1	2252		0	HAIRPIN	134736208	G to A	E. coli	562	1	No effect on growth rate.	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine	794
795	23S	96092.1	2252		0	HAIRPIN	134736208	G to C	E. coli	562	1	Reduced rate of peptidyl transferase bond formation in vitro; severely detrimental to cell growth. Double mutation (G2252C/G2253C).	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine	795
796	23S	96092.1	2252		0	HAIRPIN	134736208	G to A	E. coli	562	1	Severely detrimental to cell growth; promoted frameshifting and readthrough of nonsense codons.	1. Gregory, S.T., Lieberman, K.R., and Dahlberg, A.E. (1994) Nucleic Acids Res. 22, 279-284. 2. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169.	796
797	23S	96092.1	2252		0	HAIRPIN	134736208	G to C	E. coli	562	1	Severely detrimental to cell growth; promoted frameshifting and readthrough of nonsense codons.	1. Gregory, S.T., Lieberman, K.R., and Dahlberg, A.E. (1994) Nucleic Acids Res. 22, 279-284. 2. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169.	797
798	23S	96092.1	2252		0	HAIRPIN	134736208	G to U	E. coli	562	1	Severely detrimental to cell growth; promoted frameshifting and readthrough of nonsense codons.	1. Gregory, S.T., Lieberman, K.R., and Dahlberg, A.E. (1994) Nucleic Acids Res. 22, 279-284. 2. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169.	798
799	23S	96092.1	2253		0	HAIRPIN	134736208	G to C	E. coli	562	1	42% control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	799
800	23S	96092.1	2253		0	HAIRPIN	134736208	G to C	E. coli	562	1	Slow growth rate.	Gregory, S.T., Lieberman, K.R., and Dahlberg, A.E. (1994) Nucleic Acids Res. 22, 279-284.	800

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
801	23S	96092.1	2253		0	HAIRPIN	134736208	G to C	E. coli	562	1	Promoted frameshifting and readthrough of nonsense codons.	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. Oâ□Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine,	801
802	23S	96092.1	2253		0	HAIRPIN	134736208	G to A	E. coli	562	1	Promoted frameshifting and readthrough of nonsense codons.	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. Oâ□Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine,	802
803	23S	96092.1	2253		0	HAIRPIN	134736208	G to U	E. coli	562	1	Promoted frameshifting and readthrough of nonsense codons.	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. Oâ□Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine,	803
804	23S	96092.1	2253		0	HAIRPIN	134736208	G to U	E. coli	562	1	No effect on cell growth.		804
805	23S	96092.1	2253		0	HAIRPIN	134736208	G to A	E. coli	562	1	No effect on cell growth.		805
806	23S	96092.1	2253		0	HAIRPIN	134736208	G to A	E. coli	562	1	19% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	806
807	23S	96092.1	2253		0	HAIRPIN	134736208	G to C	E. coli	562	1	Severely detrimental to cell growth; reduced rate of peptide bond formation in vitro. Double mutations (C2253C/2252C).	1. Lieberman, K.R. and Dahlberg, A.E. (1994) J. Biol. Chem. 269, 16163-16169. 2. Samaha, R.R., Green R., and Noller, H.F. (1995) Nature 377, 309-314. 3. Oâ□Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine,	807
808	23S	96092.1	2253		0	HAIRPIN	134736208	G to U	E. coli	562	1	Less than 5% control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P., and Garrett, R.A. (1996) J. Mol. Biol. 264: 472-486.	808
809	23S	96092.1	2253		0	HAIRPIN	134736208	G to A	E. coli	562	1	Induced DMS reactivity; enhanced CMCT reactivity in G2238; induced kethoxal and CMCT reactivity in G2269 and G2271; induced CMCT reactivity in U2272; induced kethoxal reactivity in G2409 and G2410.	Gregory ST, Dahlberg AE, 1999. Mutations in the Conserved P Loop Perturb the Conformation of Two Structural Elements in the Peptidyl Transferase Center of 23 S Ribosomal RNA. J. Mol. Biol. 285: 1475- 1483.	809
810	23S	96092.1	2253		0	HAIRPIN	134736208	G to C	E. coli	562	1	Induced DMS reactivity; enhanced CMCT reactivity in G2238; induced kethoxal and CMCT reactivity in G2269 and G2271; induced CMCT reactivity in U2272; induced kethoxal reactivity in G2409 and G2410.	Gregory ST, Dahlberg AE, 1999. Mutations in the Conserved P Loop Perturb the Conformation of Two Structural Elements in the Peptidyl Transferase Center of 23 S Ribosomal RNA. J. Mol. Biol. 285: 1475- 1483.	810

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
811	23S	96092.1	2254		0	HAIRPIN	134736208	C to U	E. coli	562	1	Normal growth.	1. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32849-32856. 2. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32857-32862.	811
812	23S	96092.1	2254		0	HAIRPIN	134736208	C to U	E. coli	562	1	Normal growth. Double mutation (C2254U/G2250A).	1. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32849-32856. 2. Spahn, C., Remme, J., Schafer, M., and Nierhaus, K. (1996) J. Biol. Chem. 271: 32857-32862.	812
813	23S	96092.1	2438		2071	HELIX	134729656	U to A	Halobacterium halobium	2242	1	Amicetin resistance and reduced growth rate.	Levieu, I.G., Rodriguez-Fonseca, C., Phan, H., Garrett, R.A., Heliek, G., Noller, H.F., and Mankin, A.S (1994) EMBO J. 13, 1682-1686.	813
814	23S	96092.1	2438		2071	HELIX	134729656	U to C	Halobacterium halobium	2242	1	Amicetin resistance.	Levieu, I.G., Rodriguez-Fonseca, C., Phan, H., Garrett, R.A., Heliek, G., Noller, H.F., and Mankin, A.S (1994) EMBO J. 13, 1682-1686.	814
815	23S	96092.1	2438		2071	HELIX	134729656	U to G	Halobacterium halobium	2242	1	Unstable in presence or absence of amicetin	Levieu, I.G., Rodriguez-Fonseca, C., Phan, H., Garrett, R.A., Heliek, G., Noller, H.F., and Mankin, A.S (1994) EMBO J. 13, 1682-1686.	815
816	23S	96092.1	2447		0	MULTISTEM	134738620	G to A	Yeast mitochondria	4932	3	Chloramphenicol resistance.	Dujon, B. (1980) Cell 20, 185-197.	816
817	23S	96092.1	2447		0	MULTISTEM	134738620	G to C	Halobacterium halobium	2242	1	Anisomycin resistance.	Hummel, H. and Bäck, A. (1987) Biochimie 69, 857-861.	817
818	23S	96092.1	2450		0	MULTISTEM	134738620	A to C	E. coli	562	1	Lethal.	Vester, B. and Garrett, R.A. (1988) EMBO J. 7, 3577-3587.	818
819	23S	96092.1	2451		0	MULTISTEM	134738620	A to U	Mouse mitochondria	10090	3	Chloramphenicol resistance.	Kearsey, S.E. and Craig, I.W. (1981) Nature (London) 290: 607-608.	819
820	23S	96092.1	2451		0	MULTISTEM	134738620	A to G	E. coli	562	1	Like A2451G	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	820
821	23S	96092.1	2451		0	MULTISTEM	134738620	A to C	E. coli	562	1	Like A2451G	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	821
822	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Sulfolobus acidocaldarius	2285	1	Cbm-R, Lin-R	Aagaard, C., H. Phan, S. Trevisanato, and R. A. Garrett. 1994. A spontaneous point mutation in the single 23S rRNA gene of the thermophilic archaeon Sulfolobus acidocaldarius confers multiple drug resistance. J. Bacteriol. 176:7744-7747.	822

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823	23S	96092.1	2452		0	MULTISTEM	134738620	C to A	Human mitochondria	9606	3	Chloramphenicol resistance.	Blanc, H., Wright C.T., Bibb M.J., Wallace D.C., and Clayton D.A. (1981) Proc. Natl. Acad. Sci. USA 78, 3789-3793.	823
824	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Halobacterium	2243	1	Animosycin resistance.	Hummel, H. and Bäck, A. (1987) Biochimie 69, 857-861.	824
825	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Tetrahymena thermophila	5911		Animosycin resistance	Sweeney, R., Yao, C.H., and Yao, M.C. (1991) Genetics 127: 327-334.	825
826	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Halobacterium halobium	2242	1	Chloramphenicol resistance.	Mankin, A.S. and Garrett, R.A. (1991) J. Bacteriol. 173: 3559-3563.	826
827	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Mouse mitochondria	10090	3	Chloramphenicol resistance	Slott, E.F., Shade R.O., and Lansman, R.A. (1983) Mol. Cell. Biol. 3, 1694-1702.	827
828	23S	96092.1	2452		0	MULTISTEM	134738620	C to U	Halobacterium halobium	2242	1	Low level sparsomycin resistance	Tan, G.T., DeBlasio, A., and Mankin, A.S. (1996) J. Mol. Biol. 261, 222-230.	828
829	23S	96092.1	2453		0	MULTISTEM	134738620	A to C	Halobacterium halobium	2242	1	Anisomycin resistance	Hummel, H. and Bäck, A. (1987) Biochimie 69, 857-861.	829
830	23S	96092.1	2458		0	BULGE	134736496	G to A	E. coli	562	1	Promotes misreading; lack of mutant ribosomes in translating polysome pool.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	830
831	23S	96092.1	2458		0	BULGE	134736496	G to C	E. coli	562	1	Increased misreading.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	831
832	23S	96092.1	2458		0	BULGE	134736496	G to A	E. coli	562	1	Increased misreading. Double mutation (G2458A/U2493C).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	832
833	23S	96092.1	2458		0	BULGE	134736496	U to C	E. coli	562	1	Increased misreading. Double mutation (G2458C/U2493C).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	833
834	23S	96092.1	2460		2490	HELIX	134730736	U to G	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	834
835	23S	96092.1	2460		2490	HELIX	134730736	U to C	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	835
836	23S	96092.1	2460		2490	HELIX	134730736	U to A	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	836
837	23S	96092.1	2460		2490	HELIX	134730736	U to C	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutation (U2460C/G2490C).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	837
838	23S	96092.1	2460		2490	HELIX	134730736	U to G	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutation (U2460G/G2490A).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	838
839	23S	96092.1	2460		2490	HELIX	134730736	U to G	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutation (U2460G/G2490C).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	839
840	23S	96092.1	2460		2490	HELIX	134730736	U to G	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutation (U2460G/G2490U).	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	840
841	23S	96092.1	2477		0	HAIRPIN	134736568	U to C	E. coli	562	1	No effect on growth rate or translational fidelity.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	841
842	23S	96092.1	2477		0	HAIRPIN	134736568	U to A	E. coli	562	1	No effect on growth rate or translational fidelity.	O'Connor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	842

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
843	23S	96092.1	2490		2460	HELIX	134730736	G to A	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	843
844	23S	96092.1	2490		2460	HELIX	134730736	G to C	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	844
845	23S	96092.1	2490		2460	HELIX	134730736	G to U	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	845
846	23S	96092.1	2490		2460	HELIX	134730736	G to A	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutations (G2490A/U2460G).	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	846
847	23S	96092.1	2490		2460	HELIX	134730736	G to C	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutations (G2490C/U2460C).	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	847
848	23S	96092.1	2490		2460	HELIX	134730736	G to C	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutations (G2490C/U2460G).	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	848
849	23S	96092.1	2490		2460	HELIX	134730736	G to U	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor. Double mutations (G2490U/U2460G).	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	849
850	23S	96092.1	2492		0	BULGE	134736604	U to G	E. coli	562	1	Frameshift suppressors.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	850
851	23S	96092.1	2492		0	BULGE	134736604	U to A	E. coli	562	1	Frameshift suppressors.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	851
852	23S	96092.1	2492		0	BULGE	134736604	U to C	E. coli	562	1	Frameshift suppressors.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	852
853	23S	96092.1	2493		2459	HELIX	134730700	del U	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors.	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	853
854	23S	96092.1	2493		2459	HELIX	134730700	U to A	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors	1. Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10. 2. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	854
855	23S	96092.1	2493		2459	HELIX	134730700	U to C	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors	1. Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10. 2. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868. 3.0	855
856	23S	96092.1	2493		2459	HELIX	134730700	U to C	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	856
857	23S	96092.1	2493		2459	HELIX	134730700	U to G	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705.	857

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
858	23S	96092.1	2493		2459	HELIX	134730700	U to A	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. Frameshift suppressors	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	858
859	23S	96092.1	2493		2459	HELIX	134730700	U to C	E. coli	562	1	Increased misreading. Double mutation (U2493C/G2458A)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	859
860	23S	96092.1	2493		2459	HELIX	134730700	U to C	E. coli	562	1	Increased misreading. Double mutation (U2493C/G2458C)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	860
861	23S	96092.1	2497		0	MULTISTEM	134738620	A to G	E. coli	562	1	(With A2058G and erythromycin) Reduced growth rate.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	861
862	23S	96092.1	2499		0	MULTISTEM	134738620	C to U	Halobacterium halobium	2242	1	Sparsomycin resistance	Tan, G.T., DeBlasio, A. and Mankin, A.S. (1996) J. Mol. Biol. 261, 222-230	862
863	23S	96092.1	2500		0	MULTISTEM	134738620	U2500A/C2501A	E. coli	562	1	Inhibits binding of 1A streptogramin B, antibiotic pristinamycin 1A on peptidyl transferase loop causing inhibition of peptide elongation. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	863
864	23S	96092.1	2500		0	MULTISTEM	134738620	U2500A/C2501G	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	864
865	23S	96092.1	2500		0	MULTISTEM	134738620	U2500A/C2501U	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	865
866	23S	96092.1	2500		0	MULTISTEM	134738620	U2500G/C2501A	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	866
867	23S	96092.1	2500		0	MULTISTEM	134738620	U2500G/C2501G	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	867
868	23S	96092.1	2500		0	MULTISTEM	134738620	U2500G/C2501U	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	868

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
869	23S	96092.1	2500		0	MULTISTEM	134738620	U2500C/C2501A	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	869
870	23S	96092.1	2500		0	MULTISTEM	134738620	U2500C/C2501G	E. coli	562	1	Like U2500A/C2501A. c.	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	870
871	23S	96092.1	2500		0	MULTISTEM	134738620	U2500C/C2501A	E. coli	562	1	Like U2500A/C2501A. c	Porse BT, Garrett RA. 1999. Sites of Interaction of Streptogramin A and B Antibiotics in the Peptidyl Transferase Loop of 23 S rRNA and the Synergism of their Inhibitory Mechanisms. J. Mol. Biol. 286: 375-387.	871
872	23S	96092.1	2502		0	MULTISTEM	134738620	G to A	E. coli	562	1	Decreased growth rate	Vester, B. and Garrett, R.A. (1988) EMBO J. 7, 3577-3587	872
873	23S	96092.1	2503		0	MULTISTEM	134738620	A to C	Yeast mitochondria	4932	3	Chloramphenicol resistance	Dujon, B. (1980) Cell 20, 185-197	873
874	23S	96092.1	2503		0	MULTISTEM	134738620	A to C	E. coli	562	1	Decreased growth rate; CAMr	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	874
875	23S	96092.1	2503		0	MULTISTEM	134738620	A to G	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. CAMr	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	875
876	23S	96092.1	2504		0	MULTISTEM	134738620	U to A	E. coli	562	1	Increased readthrough of stop codons and frameshifting; lethal	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	876
877	23S	96092.1	2504		0	MULTISTEM	134738620	U to C	E. coli	562	1	Increased readthrough of stop codons and frameshifting; lethal	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	877
878	23S	96092.1	2504		0	MULTISTEM	134738620	U to C	Mouse mitochondria	10090	3	Chloramphenicol resistance	Blanc, H., Wright, C.T., Bibb, M.J., Wallace, D.C., and Clayton, D.A. (1981) Proc. Natl. Acad. Sci. USA 78, 3789-3793	878
879	23S	96092.1	2504		0	MULTISTEM	134738620	U to C	Human mitochondria	9606	3	Chloramphenicol resistance	Kearsey, S.E., and Craig, I.W. (1981) Nature (London) 290, 607-608	879
880	23S	96092.1	2505		0	MULTISTEM	134738620	G to A	E. coli	562	1	14% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	880

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
881	23S	96092.1	2505		0	MULTISTEM	134738620	G to C	E. coli	562		(With A1067U and thiostrepton) Temperature sensitive growth. a Hypersensitivity to CAM; increased sensitivity of in vitro translation. Slight increase in sensitivity to lincomycin. b No effect on translational accuracy.	1. Saarma, U. and Remme, J. (1992) Nucleic Acids Res. 23, 2396-2403. 2. Saarma, U., Lewicki, B.T.U., Margus, T., Nigul, S., and Remme, J. (1993) The Translational Apparatus: Structure, Function, Regulation and Evolution 163-172.	881
882	23S	96092.1	2505		0	MULTISTEM	134738620	G to C	E. coli	562		Excluded from 70S ribosomes; 17% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	882
883	23S	96092.1	2505		0	MULTISTEM	134738620	G to U	E. coli	562		< 5% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	883
884	23S	96092.1	2505		0	MULTISTEM	134738620	G to A	E. coli	562		Conferred resistance to the MLS drugs and chloramphenicol.	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-kelotide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	884
885	23S	96092.1	2505		0	MULTISTEM	134738620	G to C	E. coli	562		Like G2505A.	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-kelotide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	885
886	23S	96092.1	2505		0	MULTISTEM	134738620	G to U	E. coli	562		Like G2505A	Hansen LH, Mauvais P, Douthwaite S. 1999. The macrolide-kelotide antibiotic binding site is formed by structures in domains II and V of 23S ribosomal RNA. Molecular Microbiology 31 (2): 623-631.	886
887	23S	96092.1	2506		0	MULTISTEM	134738620	U to A	E. coli	562		Interfere with the binding of peptidyl-tRNA to P site of 50S subunit.	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	887
888	23S	96092.1	2506		0	MULTISTEM	134738620	U to G	E. coli	562		Like U2506A	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	888
889	23S	96092.1	2506		0	MULTISTEM	134738620	U to C	E. coli	562		Like U2056A	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	889
890	23S	96092.1	2506		0	MULTISTEM	134738620	U to A	E. coli	562		Dominant lethal; 5% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	890

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
891	23S	96092.1	2506		0	MULTISTEM	134738620	U to C	E. coli	562	1	20% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	891
892	23S	96092.1	2506		0	MULTISTEM	134738620	U to G	E. coli	562	1	< 5% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	892
893	23S	96092.1	2507		2582	HELIX	134730808	del C	E. coli	562	1	Dominant lethal; Inhibition of puromycin in reaction. b. Double mutation (del12507/G2581A)	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	893
894	23S	96092.1	2507		2582	HELIX	134730808	C to U	E. coli	562	1	Dominant lethal	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	894
895	23S	96092.1	2507		2582	HELIX	134730808	C to U	E. coli	562	1	Dominant lethal; Inhibition of puromycin in reaction. b. Double mutant (C2507U/G2581A).	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	895
896	23S	96092.1	2507		2582	HELIX	134730808	C2507U/G2581A	E. coli	562	1	Severely impaired peptidyl transferase activity. c	Nitta I, Ueda T, Watanabe K. 1998. Possible involvement of Escherichia coli 23S ribosomal RNA in peptide bond formation. RNA 4: 257-267.	896
897	23S	96092.1	2508		2580	HELIX	134730844	G to U	E. coli	562	1	Control level peptidyl transferase activity	1. Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10. 2. Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	897
898	23S	96092.1	2508		2580	HELIX	134730844	A to U	E. coli	562	1	Eryr, Cdr, Cms; abolishes methylation of 23S rRNA by ErmE.	1. Sigmund, C.D., Ettayebi, M., and Morgan, E.A. (1984) Nucleic Acids Res. 12, 4653-4663. 2. Vannuffel, P., Di Giambattista, M., and Cocito, C. (1992) J. Biol. Chem. 267, 16114-16120. 3. Douthwaite, S. and Aagaard, C. (1993) J. Mol. Biol. 232, 725-731.	898
899	23S	96092.1	2514		2570	HELIX	134730916	U to C	E. coli	562	1	Control level peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	899
900	23S	96092.1	2516		2568	HELIX	134730916	A to U	E. coli	562	1	Control level peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	900
901	23S	96092.1	2528		2535	HELIX	134730988	U to A	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. Control level peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	901
902	23S	96092.1	2528		2535	HELIX	134730988	U to C	E. coli	562	1	Control level peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	902
903	23S	96092.1	2530		0	HAIRPIN	134736676	A to G	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	903

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904	23S	96092.1	2546		0	MULTISTEM	134738296	U to C	E. coli	562	1	Control level peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	904
905	23S	96092.1	2550		2558	HELIX	134731024	G to A	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	905
906	23S	96092.1	2552		0	HAIRPIN	134736712	U to A	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	906
907	23S	96092.1	2552		0	HAIRPIN	134736712	U to C	E. coli	562	1		Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	907
908	23S	96092.1	2555		0	HAIRPIN	134736712	U to A	E. coli	562	1	Stimulates readthrough of stop codons and frameshifting; U to A is trpE91 frameshift suppressor; viable in low copy number plasmids, but lethal when expressed constitutively from lambda pL promoter	1. OâConnor, M. and Dalhberg, A.E. (1993) Proc. Natl. Acad. Sci. USA 90, 9214-9218 2. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology	908
909	23S	96092.1	2555		0	HAIRPIN	134736712	U to C	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. Control level peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	909
910	23S	96092.1	2555		0	HAIRPIN	134736712	U to C	E. coli	562	1	no effect	OâConnor, M. and Dalhberg, A.E. (1993) Proc. Natl. Acad. Sci. USA 90, 9214-9218	910
911	23S	96092.1	2555		0	HAIRPIN	134736712	U to G	E. coli	562	1	Stimulates readthrough of stop codons and frameshifting; U to A is trpE91 frameshift suppressor; viable in low copy number plasmids, but lethal when expressed constitutively from lambda pL promoter	1. OâConnor, M. and Dalhberg, A.E. (1993) Proc. Natl. Acad. Sci. USA 90, 9214-9218 2. OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology	911
912	23S	96092.1	2557		2551	HELIX	134731024	G to A	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. Intermediate decrease in peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	912
913	23S	96092.1	2561		2547	HELIX	134731024	U to C	E. coli	562	1	Small decrease in peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	913
914	23S	96092.1	2565		0	MULTISTEM	134738296	A to U	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. Very low peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	914
915	23S	96092.1	2580		2508	HELIX	134730844	U to C	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. No peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	915
916	23S	96092.1	2580		2508	HELIX	134730844	U to A	E. coli	562	1	Deleterious; <5% activity of 70S ribosomes.	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	916
917	23S	96092.1	2580		2508	HELIX	134730844	U to C	E. coli	562	1	Dominant lethal; 12% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	917
918	23S	96092.1	2580		2508	HELIX	134730844	U to C	E. coli	562	1	Reduced growth	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	918
919	23S	96092.1	2580		2508	HELIX	134730844	U to G	E. coli	562	1	Deleterious; 6% activity of 70S ribosomes.	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	919

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920	23S	96092.1	2581		0	BULGE	134736820	G to A	E. coli	562	1	Dominant lethal inhibition of puromycin in reaction	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	920
921	23S	96092.1	2581		0	BULGE	134736820	G to A	E. coli	562	1	Deleterious; 22% activity of 70S ribosomes.	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	921
922	23S	96092.1	2581		0	BULGE	134736820	G to C	E. coli	562	1	Deleterious; 13% activity of 70S ribosomes.	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	922
923	23S	96092.1	2581		0	BULGE	134736820	G to U	E. coli	562	1	Deleterious; 18% activity of 70S ribosomes.	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	923
924	23S	96092.1	2581		0	BULGE	134736820	G to A	E. coli	562	1	Dominant lethal; inhibition of puromycin in reaction. Double mutation (G2581A/del2507)	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	924
925	23S	96092.1	2582		2507	HELIX	134730808	G to C	E. coli	562	1	Less than 5% of control level peptidyl transferase activity	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	925
926	23S	96092.1	2582		2507	HELIX	134730808	G to U	E. coli	562	1	Less than 5% of control level peptidyl transferase activity	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	926
927	23S	96092.1	2582		2507	HELIX	134730808	G to A	E. coli	562	1	Less than 5% of control level peptidyl transferase activity.	1. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32849-32856 2. Spahn, C., Reeme, J., Schafer, M. and Nierhaus, K. (1996) J. Biol. Chem. 271, 32857-32862	927
928	23S	96092.1	2583		0	MULTISTEM	134738620	G to A	E. coli	562	1	Less than 5% of control level peptidyl transferase activity	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	928

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929	23S	96092.1	2583		0	MULTISTEM	134738620	G to A	E. coli	562	1	Decreased misreading in vitro; increased ribosomes sensitivity to chloramphenicol; (with A1067U and thiostrepton) temperature sensitive growth and suppression of 1067U; mistranslation effects; Hypersensitivity to CAM; increased sensitivity of in vitro tr	1. Saarma, U. and Remme, J. (1992) Nucleic Acids Res. 23, 2396-2403. 2. Saarma, U., Lewicki, B.T.U., Margus, T., Nigul, S., and Remme, J. (1993) $\hat{\Delta}$ □□The Translational Apparatus: Structure, Function, Regulation and Evolution $\hat{\Delta}$ □□ 163-172.	929
930	23S	96092.1	2583		0	MULTISTEM	134738620	G to C	E. coli	562	1	Less than 5% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	930
931	23S	96092.1	2583		0	MULTISTEM	134738620	G to U	E. coli	562	1	Dominant lethal; less than 5% of control level peptidyl transferase activity.	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	931
932	23S	96092.1	2584		0	MULTISTEM	134738620	U to A	E. coli	562	1	Deleterious; 20% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	932
933	23S	96092.1	2584		0	MULTISTEM	134738620	U to C	E. coli	562	1	Deleterious; 20% activity of 70S ribosomes	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	933
934	23S	96092.1	2584		0	MULTISTEM	134738620	U to G	E. coli	562	1	(With A2058G and erythromycin) Lethal growth effects. No peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	934
935	23S	96092.1	2584		0	MULTISTEM	134738620	U to G	E. coli	562	1	Dominant lethal	Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486	935
936	23S	96092.1	2585		0	MULTISTEM	134738620	U to A	E. coli	562	1	Dominant lethal; less than 6% of control peptidyl transferase activity; Disrupted binding of tRNA fragment, Decreased peptidyl transferase activity	1. Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486 2. Green, R., Samaha, R. and Noller, H. (1997) J. Mol. Biol. 266, 40-50.	936
937	23S	96092.1	2585		0	MULTISTEM	134738620	U to C	E. coli	562	1	Dominant lethal; less than 6% of control peptidyl transferase activity; Disrupted binding of tRNA fragment, Decreased peptidyl transferase activity	1. Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486 2. Green, R., Samaha, R. and Noller, H. (1997) J. Mol. Biol. 266, 40-50.	937
938	23S	96092.1	2585		0	MULTISTEM	134738620	U to G	E. coli	562	1	Dominant lethal; less than 6% of control peptidyl transferase activity; Disrupted binding of tRNA fragment, Decreased peptidyl transferase activity	1. Porse, B.T., Thi-Ngoc, H.P. and Garrett, R.A. (1996) J. Mol. Biol. 264, 472-486 2. Green, R., Samaha, R. and Noller, H. (1997) J. Mol. Biol. 266, 40-50.	938
939	23S	96092.1	2585		0	MULTISTEM	134738620	U to A	E. coli	562	1	Inteferes with the binding of peptidyl-tRNA to P of 50S subunit	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	939
940	23S	96092.1	2585		0	MULTISTEM	134738620	U to G	E. coli	562	1	Like U2585A	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	940
941	23S	96092.1	2585		0	MULTISTEM	134738620	U to C	E. coli	562	1	Like U2585A	Bocchetta M, Xiong L, Mankin AS. 1998. 23S rRNA positions essential for tRNA binding in ribosomal functional sites. Proc. Natl. Acad. Sci. 95: 3525-3530.	941

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
942	23S	96092.1	2589		2605	HELIX	134731060	A to G	E. coli	562	1	(With A2058G and erythromycin) Slow growth rate. Strong reduction in peptidyl transferase activity.	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	942
943	23S	96092.1	2600		2593	HELIX	134731096	A to U	E. coli	562	1	Small decrease in peptidyl transferase activity	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	943
944	23S	96092.1	2602		0	BULGE	134736892	A2602C/C2501A	E. coli	562	1	Inhibits binding of 1A streptogramin B, antibiotic pristinamycin 1A on peptidyl transferase loop causing inhibition of peptide elongation. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	944
945	23S	96092.1	2602		0	BULGE	134736892	A2602C/C2501U	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	945
946	23S	96092.1	2602		0	BULGE	134736892	A2602C/C2501G	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	946
947	23S	96092.1	2602		0	BULGE	134736892	A2602U/C2501A	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	947
948	23S	96092.1	2602		0	BULGE	134736892	A2602U/C2501U	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	948
949	23S	96092.1	2602		0	BULGE	134736892	A2602U/C2501G	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	949
950	23S	96092.1	2602		0	BULGE	134736892	A2602G/C2501A	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	950

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951	23S	96092.1	2602		0	BULGE	134736892	A2602G/C2501U	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	951
952	23S	96092.1	2602		0	BULGE	134736892	A2602G/C2501G	E. coli	562	1	Like A2602C/C2501A. c	Porse BT, Kirillov SV, Awayez MJ, Garrett RA. 1999. UV-induced modifications in the peptidyl transferase loop of 23S rRNA dependent on binding of the streptogramin B antibiotic pristinamycin IA. RNA 5: 585-595.	952
953	23S	96092.1	2607		0	MULTISTEM	134738620	G to C	E. coli	562	1	(With A1067U)	Saarma, U., Lewicki, B.T.U., Margus, T., Nigul, S., and Remme, J. (1993) The Translational Apparatus: Structure, Function, Regulation and Evolution 163-172.	953
954	23S	96092.1	2608		0	MULTISTEM	134738620	G to A	E. coli	562	1	(With A1067U)	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	954
955	23S	96092.1	2608		0	MULTISTEM	134738620	G to U	E. coli	562	1	(With A1067U)	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	955
956	23S	96092.1	2608		0	MULTISTEM	134738620	G to C	E. coli	562	1	(With A1067U)	Porse, B.T. and Garrett, R.A. (1995) J. Mol. Biol. 249, 1-10.	956
957	23S	96092.1	2611		2057	HELIX	134729548	C to G	Chlamydomonas reinhardtii	3055		Erythromycin and spiramycin resistance	Gauthier, A., Turmel, M. and Lemieux, C. (1988) Mol. Gen. Genet. 214, 192-197.	957
958	23S	96092.1	2611		2057	HELIX	134729548	C to G	Yeast mitochondria	4932	3	Erythromycin and spiramycin resistance	Sor, F. and Fukahara, H. (1984) Nucleic Acids Res. 12, 8313-8318.	958
959	23S	96092.1	2611		2057	HELIX	134729548	C to U	Chlamydomonas reinhardtii	3055		Eryr and low level lincomycin and clindamycin resistance	Harris, E.H., Burkhart, B.D., Gillham, N.W. and Boynton, J.E. (1989) Genetics 123, 281-292	959
960	23S	96092.1	2611		2057	HELIX	134729548	C to G	Chlamydomonas reinhardtii	3055		Eryr and low level lincomycin and clindamycin resistance	Harris, E.H., Burkhart, B.D., Gillham, N.W. and Boynton, J.E. (1989) Genetics 123, 281-292	960
961	23S	96092.1	2611		2057	HELIX	134729548	C to U	E. coli	562	1	Slightly Eryr; reduced methylation Double mutation (C2611U/G2057A)	Vester, B., Hansen, L.H., and Douthwaite, S. (1995) RNA 1, 501-509	961
962	23S	96092.1	2611		2057	HELIX	134729548	C to G	Chlamydomonas moewusii chl.	3054	2	Ery-R, Spi-LR	Gauthier, A., M. Turmel, and C. Lemieux. 1988. Mapping of chloroplast mutations conferring resistance to antibiotics in Chlamydomonas: evidence for a novel site of streptomycin resistance in the small subunit rRNA. Mol. Gen. Genet. 214:192-197.	962

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963	23S	96092.1	2611		2057	HELIX	134729548	C to G/U	Chlamydomonas reinhardtii chl.	3055	2	Ery-R, Lin-MR	Harris, E. H., B. D. Burkhart, N. W. Gillham, and J. E. Boynton. 1989. Antibiotic resistance mutations in the chloroplast 16S and 23S rRNA genes of Chlamydomonas reinhardtii: correlation of genetic and physical maps of the chloroplast genome. Genetics.	963
964	23S	96092.1	2611		2057	HELIX	134729548	C to U	Escherichia coli	562	1	Ery-R, Spi-S, Tyl-S, Lin-S	Vannuffel, P., M. Di Giambattista, E. A. Morgan, and C. Cocito. 1992. Identification of a single base change in ribosomal RNA leading to erythromycin resistance. J. Biol. Chem. 267:8377-8382.	964
965	23S	96092.1	2611		2057	HELIX	134729548	C to A/G	Streptococcus pneumoniae	1313	1	Mac-R, SBâ□□S	Tait-Kamradt, A., T. Davies, M. Cronan, M. R. Jacobs, P. C. Appelbaum, and J. Sutcliffe. 2000. Mutations in 23S rRNA and L4 ribosomal protein account for resistance in Pneumococcal strains selected in vitro by macrolide passage. Antimicrobial Agents and	965
966	23S	96092.1	2611		2057	HELIX	134729548	C to G	Saccharomyces cerevisiae mit.	4932	3	Ery-R, Spi-R	Sor, F., and H. Fukuhara. 1984. Erythromycin and spiramycin resistance mutations of yeast mitochondria: nature of the rib2 locus in the large ribosomal RNA gene. Nucleic Acids Res. 12:8313-8318.	966
967	23S	96092.1	2611		2057	HELIX	134729548	C to U	Saccharomyces cerevisiae mit.	4932	3	Ery-S, Spi-R	Sor, F., and H. Fukuhara. 1984. Erythromycin and spiramycin resistance mutations of yeast mitochondria: nature of the rib2 locus in the large ribosomal RNA gene. Nucleic Acids Res. 12:8313-8318.	967
968	23S	96092.1	2654		0	HAIRPIN	134736928	A to C	E. coli	562	1	Mildly restrictive effect on fidelity. a	Oâ□□Connor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	968
969	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	Significant increase in stop codon readthrough and frameshifting. a	Oâ□□Connor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	969
970	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	Stimulates readthrough of stop codons and frameshifting	Oâ□□Connor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	970

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971	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	no effect	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	971
972	23S	96092.1	2654		0	HAIRPIN	134736928	A to C	E. coli	562	1	no effect	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	972
973	23S	96092.1	2654		0	HAIRPIN	134736928	A to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	973
974	23S	96092.1	2654		0	HAIRPIN	134736928	A to C	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654C/C2666A)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	974
975	23S	96092.1	2654		0	HAIRPIN	134736928	A to C	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654C/C2666G)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	975
976	23S	96092.1	2654		0	HAIRPIN	134736928	A to C	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654C/C2666U)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	976
977	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654G/C2666A)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	977
978	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	Increased stop codon readthrough and frameshifting. a Double mutation (A2654G/C2666G)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	978
979	23S	96092.1	2654		0	HAIRPIN	134736928	A to G	E. coli	562	1	Significant increase in stop codon readthrough and frameshifting. a Double mutation (A2654G/C2666G)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	979
980	23S	96092.1	2654		0	HAIRPIN	134736928	A to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654U/C2666A)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	980
981	23S	96092.1	2654		0	HAIRPIN	134736928	A to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654U/C2666G)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	981
982	23S	96092.1	2654		0	HAIRPIN	134736928	A to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (A2654U/C2666U)	OâConnor, M. and Dahlberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	982
983	23S	96092.1	2655		0	HAIRPIN	134736928	del G	E. coli	562	1	EFG elongation factor does not bind to sarcin/ricin RNA region.	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	983

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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
984	23S	96092.1	2655		0	HAIRPIN	134736928	G to A	E. coli	562	1	Like ?G2655	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	984
985	23S	96092.1	2655		0	HAIRPIN	134736928	G to U	E. coli	562	1	Like ?G2655	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	985
986	23S	96092.1	2655		0	HAIRPIN	134736928	G to C	E. coli	562	1	Like ?G2655	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	986
987	23S	96092.1	2658		0	HAIRPIN	134736928	C to G	E. coli	562	1	Undetectable levels of mutant 23S rRNA in 50S, 70S or polysome fractions	Marchant, A. and Hartley, M.R. (1994) Eur. J. Biochem. 226, 141-147	987
988	23S	96092.1	2658		0	HAIRPIN	134736928	C to G	E. coli	562	1	Reduced levels of mutant 23S rRNA in 50S, 70S or polysome fractions. Double mutation (C2658G/G2663C)	Oâ–Connor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	988
989	23S	96092.1	2660		0	HAIRPIN	134736928	A to G	E. coli	562	1	Undetectable levels of mutant 23S rRNA in 50S, 70S or polysome fractions	Oâ–Connor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	989
990	23S	96092.1	2660		0	HAIRPIN	134736928	del A	E. coli	562	1	EFG elongation factor does not bind to sarcin/ricin RNA region.	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	990
991	23S	96092.1	2660		0	HAIRPIN	134736928	A to G	E. coli	562	1	Like ?A2660	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	991

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
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Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
992	23S	96092.1	2660		0	HAIRPIN	134736928	A to U	E. coli	562	1	Like ?A2660	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	992
993	23S	96092.1	2660		0	HAIRPIN	134736928	A to C	E. coli	562	1	Like ?A2660	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	993
994	23S	96092.1	2661		0	HAIRPIN	134736928	del C	E. coli	562	1	EFG elongation factor does not bind to sarcin/ricin RNA region.	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	994
995	23S	96092.1	2661		0	HAIRPIN	134736928	C to A	E. coli	562	1	Like ?C2661	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	995
996	23S	96092.1	2661		0	HAIRPIN	134736928	C to G	E. coli	562	1	Like ?C2661	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	996
997	23S	96092.1	2661		0	HAIRPIN	134736928	C to U	E. coli	562	1	Like ?C2661	Munishkin A, Wool IG. 1997. The ribosome-in-pieces: Binding of elongation factor EF-G to oligoribonucleotides that mimic the sarcin/ricin and thiostrepton domains of 23S ribosomal RNA. Proc. Natl. Acad. Sci. 94: 12280-12284.	997
998	23S	96092.1	2661		0	HAIRPIN	134736928	G to C	E. coli	562	1	Decreased misreading; streptomycin dependent when expressed with Smr, hyperaccurate S12 mutation.	1. Tappich, W.E. and Dalhberg, A.E. (1990) EMBO J. 9, 2649-2655 2. Tapio, S. and Isaksson, L.A. (1991) Eur. J. Biochem. 202, 981-984 3. Melancon, P., Tappich, W. and Brakier-Gingras, L. (1992) J. Bacteriol. 174, 7896-7901 4. Bilgin, N. and Ehrenberg,	998
Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #

Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #
999	23S	96092.1	2661		0	HAIRPIN	134736928	G to U	E. coli	562	1		Melancon, P., Tapprich, W. and Brakier-Gingras, L. (1992) J. Bacteriol. 174, 7896-7901	999
1000	23S	96092.1	2661		0	HAIRPIN	134736928	G to A	E. coli	562	1	Growth unaffected; incorporated into ribosomes at wild-type levels	Marchant, A. and Hartley, M.R. (1994) Eur. J. Biochem. 226, 141-147	1000
1001	23S	96092.1	2663		0	HAIRPIN	134736928	G to C	E. coli	562	1	Reduced levels of mutant 23S rRNA in 50S, 70S or polysome fractions	Marchant, A. and Hartley, M.R. (1994) Eur. J. Biochem. 226, 141-147	1001
1002	23S	96092.1	2663		0	HAIRPIN	134736928	G to C	E. coli	562	1	Reduced levels of mutant 23S rRNA in 50S, 70S or polysome fractions. Double mutation (G2663C/C2658G)	Marchant, A. and Hartley, M.R. (1994) Eur. J. Biochem. 226, 141-147	1002
1003	23S	96092.1	2664		0	HAIRPIN	134736928	G to C	E. coli	562	1	Decreased growth rate, reduced viability and incorporation into polysomes.	Marchant, A. and Hartley, M.R. (1994) Eur. J. Biochem. 226, 141-147	1003
1004	23S	96092.1	2665		0	HAIRPIN	134736928	del G	E. coli	562	1	Not active in protein synthesis; lethal; resistant to sarcin; erythromycin growth inhibited. c	Macbeth MR, Wool IG. 1999. The Phenotype of Mutations of G2655 in the Sarcin/Ricin Domain of 23S Ribosomal RNA. J. Mol. Biol. 285: 965-975.	1004
1005	23S	96092.1	2665		0	HAIRPIN	134736928	G to C	E. coli	562	1	Like ?G2665. c	Macbeth MR, Wool IG. 1999. The Phenotype of Mutations of G2655 in the Sarcin/Ricin Domain of 23S Ribosomal RNA. J. Mol. Biol. 285: 965-975.	1005
1006	23S	96092.1	2665		0	HAIRPIN	134736928	G to U	E. coli	562	1	Not active in protein synthesis; lethal; resistance to sarcin. c	Macbeth MR, Wool IG. 1999. The Phenotype of Mutations of G2655 in the Sarcin/Ricin Domain of 23S Ribosomal RNA. J. Mol. Biol. 285: 965-975.	1006
1007	23S	96092.1	2665		0	HAIRPIN	134736928	G to A	E. coli	562	1	Not lethal; resistant to sarcin; decreased protein synthesis activity. c	Macbeth MR, Wool IG. 1999. The Phenotype of Mutations of G2655 in the Sarcin/Ricin Domain of 23S Ribosomal RNA. J. Mol. Biol. 285: 965-975.	1007
1008	23S	96092.1	2666		0	HAIRPIN	134736928	C to A	E. coli	562	1	No effect on stop codon readthrough or frameshifting. a	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1008
1009	23S	96092.1	2666		0	HAIRPIN	134736928	C to A	E. coli	562	1	no effect	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	1009
1010	23S	96092.1	2666		0	HAIRPIN	134736928	C to G	E. coli	562	1	no effect	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	1010
1011	23S	96092.1	2666		0	HAIRPIN	134736928	C to G	E. coli	562	1	no effect on stop codon readthrough or frameshifting. a	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1011
1012	23S	96092.1	2666		0	HAIRPIN	134736928	C to U	E. coli	562	1	Increased stop codon readthrough and frameshifting. a	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1012

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1013	23S	96092.1	2666		0	HAIRPIN	134736928	C to U	E. coli	562	1	Promotes misreading; trpE91 frameshift suppressor	OâConnor, M., Brunelli, C.A., Firpo, M.A., Gregory, S.T., Lieberman, K.R., Lodmell, J.S., Moine, H., Van Ryk, D.I., and Dahlberg, A.E. (1995) Biochem. Cell Biology 73, 859-868.	1013
1014	23S	96092.1	2666		0	HAIRPIN	134736928	C to A	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666A/A2654C)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1014
1015	23S	96092.1	2666		0	HAIRPIN	134736928	C to A	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666A/A2654G)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1015
1016	23S	96092.1	2666		0	HAIRPIN	134736928	C to A	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666A/A2654U)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1016
1017	23S	96092.1	2666		0	HAIRPIN	134736928	C to G	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666G/A2654C)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1017
1018	23S	96092.1	2666		0	HAIRPIN	134736928	C to G	E. coli	562	1	Increased stop codon readthrough and frameshifting. a Double mutation (C2666G/A2654C)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1018
1019	23S	96092.1	2666		0	HAIRPIN	134736928	C to G	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666G/A2654U)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1019
1020	23S	96092.1	2666		0	HAIRPIN	134736928	C to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666U/A2654C)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1020
1021	23S	96092.1	2666		0	HAIRPIN	134736928	C to U	E. coli	562	1	Significant increase in stop codon readthrough and frameshifting. a Double mutation (C2666U/A2654G)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1021
1022	23S	96092.1	2666		0	HAIRPIN	134736928	C to U	E. coli	562	1	Minor increase in stop codon readthrough and frameshifting. a Double mutation (C2666U/A2654U)	OâConnor, M. and Dalhberg, A.E. (1996) Nucleic Acids Res. 24, 2701-2705	1022
Row #	Type	Reference Sequence (ID.Version)	Position	Position Footnote	Pair	Interaction Type	Interaction ID	Alteration	Organism	TaxID	Cell Location ID	Phenotype	Reference(s)	Row #

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