

## 3004615: Cytomegalovirus Drug Resistance by Next Generation Sequencing, Ganciclovir, Foscarnet, Cidofovir, Maribavir and Letermovir

### EVALUATED MUTATIONS

Gene	Variant	Cidovir	Foscarnet	Ganciclovir	Maribavir	Letermovir	Confirmed by Phenotyping	References
UL27	A269T	-	-	-	P	-	Y	1
UL27	A406V	-	-	-	P	-	Y	1, 2
UL27	C415*	-	-	-	P	-	Y	1, 2
UL27	D534Y	-	-	-	P	-	Y	3
UL27	E22*	-	-	-	P	-	Y	1
UL27	K89N	-	-	-	S	-	Y	4
UL27	L193F	-	-	-	P	-	Y	1
UL27	L335P	-	-	-	R	-	Y	1, 5
UL27	L426F	-	-	-	P	-	Y	1
UL27	R233S	-	-	-	P	-	Y	2, 3
UL27	R448P	-	-	-	P	-	Y	3
UL27	V353E	-	-	-	P	-	Y	1
UL27	W153R	-	-	-	P	-	Y	1
UL27	W362*	-	-	-	P	-	Y	1
UL27	W362R	-	-	-	P	-	Y	2
UL54	883-884ins	-	-	-	-	-	N	6
UL54	981-982del	R	R	R	-	-	Y	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
UL54	A505V	P	S	P	-	-	Y	6, 13
UL54	A543P	R	S	R	-	-	Y	14, 18
UL54	A692S	S	R	S	-	-	Y	9
UL54	A809V	P	R	R	-	-	Y	8, 9, 10, 13, 17, 19, 20, 21, 22, 23
UL54	A834P	R	R	R	-	-	Y	12, 13, 24
UL54	A987G	R	S	R	-	-	Y	8, 13, 17, 25, 26, 27, 28
UL54	A987V	S	R	S	-	-	Y	16, 17
UL54	C524del	R	S	R	-	-	Y	13, 29
UL54	C539G	R	S	R	-	-	Y	13, 30
UL54	C539R	R	S	R	-	-	Y	31, 32
UL54	C590F	S	R	S	-	-	Y	33
UL54	D301N	R	S	R	-	-	Y	9, 10, 13, 17
UL54	D413A	R	S	R	-	-	Y	12, 13, 34
UL54	D413E	R	S	R	-	-	Y	8, 9, 10, 12, 13, 26, 35, 36
UL54	D413N	R	S	R	-	-	Y	13, 30
UL54	D413Y	R	S	R	-	-	Y	13, 37
UL54	D515E	P	P	R	-	-	Y	8, 38, 39
UL54	D515G	S	S	S	-	-	Y	9

Gene	Variant	Cidovir	Foscarnet	Ganciclovir	Maribavir	Letermovir	Confirmed by Phenotyping	References
UL54	D515Y	P	P	R	-	-	Y	13, 14, 15, 17, 39
UL54	D542E	R	S	S	-	-	Y	13, 40
UL54	D588E	S	R	S	-	-	Y	8, 26, 28
UL54	D588N	P	R	R	-	-	Y	10, 13, 21, 26, 41
UL54	D594N	S	S	S	-	-	Y	16
UL54	E303D	R	S	R	-	-	Y	13, 37
UL54	E303G	R	S	R	-	-	Y	13, 37
UL54	E756D	S	R	S	-	-	Y	9, 10, 13
UL54	E756G	S	R	S	-	-	Y	42
UL54	E756K	P	R	R	-	S	Y	9, 10, 13, 21, 26, 43, 44, 45, 46
UL54	E756Q	S	R	S	-	-	Y	10, 13, 19, 47
UL54	E951D	S	R	R	-	-	Y	13, 22
UL54	E989D	P	R	R	-	-	Y	16
UL54	F412C	R	S	R	-	-	Y	8, 10, 13, 17, 28, 48
UL54	F412L	R	S	R	-	-	Y	13, 17, 21
UL54	F412S	R	S	R	-	-	Y	13, 21, 32, 49
UL54	F412V	R	S	R	-	-	Y	8, 13, 26, 28
UL54	F595I	S	R	S	-	-	Y	13, 31, 32
UL54	G841A	R	R	R	-	-	Y	12, 13, 20
UL54	G841S	S	P	P	-	-	Y	6
UL54	G971D	S	S	S	-	-	Y	9
UL54	H600L	R	R	R	-	-	Y	42
UL54	I521T	R	S	R	-	-	Y	13, 38, 50
UL54	I722V	R	S	R	-	-	N	8
UL54	I726T	P	S	P	-	-	Y	6, 13
UL54	I726V	R	S	R	-	-	Y	6, 13
UL54	K493N	R	R	R	-	-	Y	16
UL54	K500N	R	S	R	-	-	Y	13, 31, 32
UL54	K513E	R	S	R	-	-	Y	8, 10, 13, 26, 28
UL54	K513N	R	S	R	-	-	Y	8, 10, 13, 26, 35, 51, 52
UL54	K513Q	R	S	R	-	-	Y	33
UL54	K513R	R	S	R	-	-	Y	8, 13, 17, 30
UL54	K513T	R	S	R	-	-	Y	16
UL54	K805Q	R	S	S	-	-	Y	8, 13, 19, 20, 28
UL54	L501F	R	S	R	-	-	Y	8, 26, 33, 35, 49, 53
UL54	L501I	R	S	R	-	-	Y	8, 10, 13, 26, 28, 54
UL54	L516M	S	S	S	-	-	Y	55
UL54	L516P	R	S	R	-	-	Y	15, 17
UL54	L516R	R	S	R	-	-	Y	9, 10, 13
UL54	L516W	R	S	R	-	-	Y	13, 56
UL54	L545F	R	S	R	-	-	Y	33
UL54	L545S	R	S	R	-	-	Y	8, 10, 13, 28, 31, 57
UL54	L545W	R	S	R	-	-	Y	13, 17, 21, 32

Gene	Variant	Cidovir	Foscarnet	Ganciclovir	Maribavir	Letermovir	Confirmed by Phenotyping	References
UL54	L565V	P	R	P	-	-	Y	16
UL54	L773V	R	R	R	-	-	Y	13, 30, 58
UL54	L776M	S	R	R	-	-	Y	12, 13, 59
UL54	L802M	S	R	P	-	-	Y	10, 12, 13, 19, 26, 28, 31, 41, 48, 57
UL54	L802V	S	S	P	-	-	Y	31
UL54	L862F	S	S	P	-	-	Y	31
UL54	L897P	-	-	S	-	-	Y	60
UL54	L957F	S	S	R	-	-	Y	13, 31, 32
UL54	M393K	R	R	R	-	-	N	8, 61
UL54	M393R	R	R	R	-	-	N	8, 61
UL54	M844T	S	R	S	-	-	Y	13, 62
UL54	M844V	S	R	R	-	-	Y	13, 62
UL54	N408D	R	S	R	-	-	Y	8, 10, 13, 17, 26, 28, 31, 57, 63
UL54	N408H	R	S	R	-	-	Y	33
UL54	N408K	R	S	R	-	-	Y	13, 17, 21, 24, 37
UL54	N408S	R	S	R	-	-	Y	13, 29, 64
UL54	N410K	R	S	R	-	-	Y	9, 13, 17
UL54	N495K	S	R	S	-	-	Y	12, 13, 22, 65
UL54	P488R	R	S	R	-	-	Y	31, 32
UL54	P497S	R	S	P	-	-	Y	16
UL54	P522A	R	S	R	-	-	Y	8, 13, 50
UL54	P522S	R	S	R	-	-	Y	8, 13, 17, 21, 28, 50
UL54	P522T	R	S	R	-	-	Y	33
UL54	P829S	S	S	R	-	-	Y	13, 31, 32
UL54	Q578H	R	R	R	-	-	Y	13, 17, 21, 32, 58
UL54	Q578L	S	P	P	-	-	Y	6, 13
UL54	Q783R	S	P	P	-	-	Y	22
UL54	Q807A	-	R	-	-	-	Y	19
UL54	R1052C	S	S	S	-	-	Y	66
UL54	S290R	S	R	P	-	-	Y	13, 22
UL54	S585A	S	R	S	-	-	Y	13, 31, 32
UL54	T419M	-	R	S	-	-	N	58
UL54	T503A	R	S	R	-	-	Y	33
UL54	T503I	R	S	R	-	-	Y	8, 9, 10, 12, 13
UL54	T552N	S	R	R	-	-	Y	13, 22, 31, 32
UL54	T700A	P	R	S	-	-	Y	8, 10, 13, 17, 19, 23, 28, 67
UL54	T813S	R	R	R	-	-	Y	12, 13, 20
UL54	T821I	S	R	R	-	-	Y	8, 10, 12, 13, 19, 28
UL54	T838A	S	R	S	-	-	Y	12, 13, 41
UL54	V526L	R	S	R	-	-	Y	13, 44
UL54	V715A	S	R	S	-	-	Y	13, 56

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UL54	V715M	S	R	S	-	-	Y	8, 10, 13, 19, 23, 28, 47, 67
UL54	V781I	S	R	P	-	-	Y	13, 21, 26, 28
UL54	V787A	S	R	R	-	-	Y	13, 39, 46
UL54	V787E	R	R	R	-	-	Y	18, 46
UL54	V787I	-	R	-	-	-	N	10
UL54	V787L	S	R	R	-	-	Y	12, 13, 19, 31, 47, 68
UL54	V812L	R	R	R	-	-	Y	8, 10, 12, 13, 19, 31, 37, 41, 52
UL54	V823A	R	S	R	-	-	Y	16
UL54	V946L	S	R	S	-	-	Y	13, 31, 32
UL54	Y751H	R	S	R	-	-	N	8
UL56	A365S	-	-	-	-	R	Y	14, 18
UL56	C25F	-	-	-	-	R	Y	14
UL56	C325F	-	-	-	-	R	Y	69, 70
UL56	C325R	-	-	-	-	R	Y	69, 70
UL56	C325W	-	-	-	-	R	Y	14, 70
UL56	C325Y	-	-	-	-	R	Y	14, 69, 70, 71
UL56	E237D	-	-	-	-	R	Y	69, 70, 72
UL56	E237G	S	S	-	-	R	Y	70, 73
UL56	F261C	-	-	-	-	R	Y	69, 70
UL56	F261L	-	-	-	-	R	Y	69, 70, 72
UL56	F261S	-	-	-	-	R	N	70
UL56	K258E	-	-	-	-	R	Y	72
UL56	L241P	-	-	-	-	R	Y	69, 71, 74, 75
UL56	L254F	-	-	-	-	R	Y	18, 75
UL56	L257F	-	-	-	-	R	Y	14, 18, 75
UL56	L257I	-	-	-	-	R	Y	69, 70
UL56	L328V	-	-	-	-	R	Y	14, 18
UL56	M329T	-	-	-	-	R	Y	69, 70, 72
UL56	N232Y	-	-	-	-	R	Y	72
UL56	N368D	-	-	-	-	R	Y	18, 75
UL56	Q204R	-	-	-	-	P	Y	72
UL56	R369G	-	-	-	-	R	Y	70, 71
UL56	R369M	-	-	-	-	R	Y	70, 71, 75
UL56	R369S	-	-	-	-	R	Y	70, 71, 74
UL56	R369T	S	S	S	-	R	Y	18, 73
UL56	S229F	-	-	-	-	R	Y	18, 75
UL56	T244K	-	-	-	-	R	Y	69, 70
UL56	T244R	-	-	-	-	R	N	70
UL56	V231A	-	-	-	-	R	Y	69, 70
UL56	V231L	-	-	-	-	R	Y	14, 69, 70, 71, 75
UL56	V236A	-	-	-	-	R	Y	14, 18
UL56	V236L	-	-	-	-	R	Y	69, 70

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UL56	V236M	S	S	S	-	R	Y	14, 45, 70, 71, 75, 76
UL56	Y321C	-	-	-	-	R	Y	69, 70
UL97	590-593del	S	S	R	-	-	Y	8, 57
UL97	590-600del	-	-	R	-	-	N	8, 77
UL97	590-603del	-	-	R	-	-	N	8, 35
UL97	590-607del	-	-	R	-	-	N	13
UL97	591-594del	-	-	R	-	-	Y	8, 10, 78, 79
UL97	591-607del	-	-	R	-	-	Y	8, 80
UL97	595-603del	-	S	R	-	-	Y	8, 10, 68, 79, 81
UL97	597-598del	-	-	R	-	-	Y	13, 79
UL97	597-599del	-	-	R	-	-	Y	56, 79
UL97	597-603del	-	-	-	-	-	N	49
UL97	600-601del	-	-	R	-	-	Y	8, 13, 68, 79
UL97	601-602del	-	-	R	-	-	Y	13, 79
UL97	601-603del	S	S	R	-	-	Y	34, 79
UL97	A590T	-	-	R	-	-	N	8, 78, 82
UL97	A591D	-	-	R	-	-	N	8, 78, 82
UL97	A591V	-	-	R	-	-	Y	13, 14, 79
UL97	A594E	-	-	R	-	-	Y	12, 13, 83
UL97	A594G	-	-	R	-	-	Y	13, 64, 84
UL97	A594P	-	-	R	-	-	Y	8, 33, 49, 85, 86
UL97	A594S	-	-	R	-	-	Y	18, 87
UL97	A594T	-	-	R	-	-	Y	10, 13, 43, 56, 78, 80, 88, 89
UL97	A594V	-	-	R	-	-	Y	10, 11, 13, 49, 67, 77, 78, 79, 85, 88, 90
UL97	A606D	-	-	P	-	-	N	8, 78, 82
UL97	A613V	-	-	R	-	-	Y	13, 55, 64
UL97	A619V	-	-	S	-	-	Y	13, 56
UL97	A674T	-	-	S	-	-	Y	13, 91
UL97	C480F	-	-	R	R	-	Y	16, 18
UL97	C480R	-	-	R	R	-	Y	13, 92
UL97	C518Y	-	-	R	-	-	Y	13, 64, 93
UL97	C592F	-	-	R	-	-	N	8
UL97	C592G	S	S	R	-	-	Y	10, 11, 13, 16, 22, 26, 78, 79, 80, 85, 90
UL97	C603R	-	-	R	-	-	Y	12, 13, 90, 94
UL97	C603S	-	-	P	-	-	Y	12, 13, 83, 90
UL97	C603W	S	S	R	-	-	Y	8, 10, 13, 49, 51, 78, 85, 90
UL97	C603Y	-	-	R	-	-	N	8, 78, 82
UL97	C607F	-	-	R	-	-	Y	8, 13, 80, 88

Gene	Variant	Cidovir	Foscarnet	Ganciclovir	Maribavir	Letermovir	Confirmed by Phenotyping	References
UL97	C607Y	-	S	R	-	-	Y	8, 10, 13, 49, 78, 80, 95, 96
UL97	D456N	-	-	R	R	-	Y	18, 92
UL97	D605E	-	-	S	-	-	Y	11, 13, 18
UL97	E362D	-	-	R	S	-	Y	97
UL97	E596D	-	-	S	-	-	Y	13, 38
UL97	E596G	-	-	R	-	-	Y	8, 10, 13, 43, 51, 78, 80
UL97	E596Q	-	-	R	-	-	Y	33
UL97	E596Y	-	-	R	-	-	Y	13, 38
UL97	E596del	-	-	R	-	-	Y	13, 79
UL97	E655K	-	-	S	-	-	Y	13, 44
UL97	F342S	-	-	R	R	-	Y	13, 98, 99, 100
UL97	F342Y	-	-	R	R	-	Y	18, 101
UL97	G598S	-	-	R	-	-	Y	8, 10, 102
UL97	G598V	-	-	R	-	-	N	8, 82
UL97	H411L	-	-	-	R	-	Y	3, 18, 103
UL97	H411N	-	-	-	R	-	Y	3, 18, 103
UL97	H411Y	-	-	-	R	-	Y	3, 16, 18, 103
UL97	H520Q	S	S	R	-	-	Y	10, 13, 49, 78, 85, 90
UL97	I610T	-	-	R	-	-	Y	13, 38
UL97	K355M	-	-	R	R	-	Y	13, 92, 98
UL97	K355del	-	-	R	R	-	Y	98
UL97	K359E	-	-	R	S	-	Y	18, 101
UL97	K359N	-	-	R	S	-	Y	97
UL97	K359Q	-	-	R	S	-	Y	18, 101
UL97	K599E	-	-	S	-	-	Y	13, 79
UL97	K599M	-	-	R	-	-	N	8, 78
UL97	K599R	-	-	S	-	-	Y	13, 83
UL97	K599T	S	-	R	-	-	Y	8, 13, 104
UL97	K599del	-	-	R	-	-	Y	13, 79
UL97	L337M	-	-	-	R	-	Y	3, 18
UL97	L348V	-	-	S	R	-	Y	97
UL97	L397R	-	-	S	R	-	Y	3, 18, 105
UL97	L405P	-	-	R	-	-	Y	13, 83
UL97	L595F	-	-	R	-	-	Y	8, 10, 13, 78, 106
UL97	L595S	-	-	R	-	-	Y	10, 11, 13, 49, 67, 77, 78, 85, 90
UL97	L595T	S	S	R	-	-	N	8, 51, 78
UL97	L595W	-	-	R	-	-	Y	8, 10, 13, 78, 80, 85
UL97	L595del	-	-	R	-	-	Y	8, 13, 77, 78, 79, 107
UL97	L600I	-	-	S	-	-	Y	13, 83
UL97	L600del	-	-	R	-	-	Y	8, 10, 13, 43, 78, 79, 80

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UL97	L634Q	-	-	S	-	-	Y	13, 80
UL97	M460I	S	S	R	-	-	Y	10, 13, 26, 49, 67, 78, 85, 90, 108
UL97	M460L	-	-	R	-	-	N	8, 82
UL97	M460T	-	-	R	-	-	Y	13, 83, 90
UL97	M460V	-	S	R	-	-	Y	10, 11, 13, 34, 38, 58, 77, 78, 85, 88, 90
UL97	M615V	-	-	S	-	-	Y	13, 94
UL97	N597D	-	-	S	-	-	Y	13, 109
UL97	N597I	-	-	R	-	-	N	8, 78
UL97	P521L	-	-	R	R	-	Y	13, 98
UL97	T409M	-	-	-	R	-	Y	3, 16, 18
UL97	T601M	-	-	S	-	-	Y	13, 79
UL97	T601del	-	-	R	-	-	Y	13, 79, 110
UL97	V345I	-	-	S	S	-	Y	97
UL97	V353A	-	-	-	R	-	Y	1, 3, 18
UL97	V356G	-	-	R	R	-	Y	13, 98, 99
UL97	V466G	-	-	R	R	-	Y	12, 13, 94, 98
UL97	Y617H	-	-	S	-	-	Y	13, 91
UL97	Y617del	-	-	R	R	-	Y	18, 92

\* = stop codon

del = deletion

R = "Resistant". Resistant indicates evidence of drug resistance compared with a wild-type virus.

P = "Possible Resistance". Possible resistance indicates mutations were detected with borderline-level drug resistance or conflicting resistance status reported in the literature.

S = "Sensitive". Ignored by the plugin and reported as additional variant.

'-' = No known resistance-association or phenotypically confirmed sensitivity to specified drug. Ignored in the analysis.

Y = "Yes". Mutation's resistance profile was confirmed by marker transfer/phenotyping experiments.

N = "No". Mutation's resistance profile has not been confirmed by marker transfer/phenotyping experiments.

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