

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 PB2

B/Ann Arbor/1/1966	MTLAKIELLLKQLLRDNEAKTVLKQTTVDQYNIIRKFNTSRIERNPSLRMKWAMCSNFPLA
B/Brisbane/60/2008	MTLAKIELLLKQLLRDNEAKTVLKQTTVDQYNIIRKFNTSRIEKNPSLRMKWAMCSNFPLA
B/Ann Arbor/1/1966	LTKGDMANRIPLEYKGIIRLKTNAEDIGTKGQMCSIAAVTWNTYGPIDTEGFEKVYESF
B/Brisbane/60/2008	LTKGDMANRIPLEYKGIQLKTNAEDIGTKGQMCSIAAVTWNTYGPIDTEGFERVYESF
B/Ann Arbor/1/1966	FLRKMRLDNATWGRITFGPVERVRKRVLLNPLTKEMPPDEASNVIMEILFPKEAGIPRES
B/Brisbane/60/2008	FLRKMRLDNATWGRITFGPVERVRKRVLLNPLTKEMPPDEASNVIMEILFPKEAGIPRES
B/Ann Arbor/1/1966	TWMHRELIIKEKREKLKGTMITPIVLAYMLERELVARRRFLPVAGATSAEFIEMLHCLQGE
B/Brisbane/60/2008	TWTHRELIIKEKREKLKGTMITPIVLAYMLERELVARRRFLPVAGATSAEFIEMLHCLQGE
B/Ann Arbor/1/1966	NWRQIYHPGGNKLTESRSQSMIVACRKIVRRSIVASNPLELAVEIANKTVIDTEPLKSCL
B/Brisbane/60/2008	NWRQIYHPGGNKLTESRSQSMIVACRKIIIRRSIVASNPLELAVEIANKTVIDTEPLKSCL
B/Ann Arbor/1/1966	AAIDGGDVACDIIRAALGLKIRQRQFRGLELKRISGRGFKNDDEEILIGNGTIQKIGIWD
B/Brisbane/60/2008	AAXDGGDVACDIIRAALGLKIRQRQFRGLELKRISGRGFKNDDEEILIGNGTIQKIGIWD
B/Ann Arbor/1/1966	GEEEFHVRCGECRGILKKSCKMRMEKLLINSAKKEDMKDLIILCMVFSQDTRMFQGVGEI
B/Brisbane/60/2008	GEEEFHVRCGECRGILKKSCKMKLEKLLINSAKKEDMRDLIILCMVFSQDTRMFQGVGEI
B/Ann Arbor/1/1966	NFLNRAGQLLSPMYQLQRYFLNRSNDLFDQWGYEESP
B/Brisbane/60/2008	NFLNRAGQLLSPMYQLQRYFLNRSNDLFDQWGYEESPKASELHGINESMNASDYTLKGIV
B/Ann Arbor/1/1966	VTKNVIDDFSSITEKVSITKNLSLIKRTGEVIMGANDVSELESQAQLMITYDTPKMWEM
B/Brisbane/60/2008	VTRNVIDDFSSITEKVSITKNLSLIKRTGEVIMGANDVSELESQAQLMITYDTPKMWEM
B/Ann Arbor/1/1966	GTTKELVQNTYQWVLKNLVTLKAQFLLGKEDMFQWDAFEAFESIIPQKMAGQYSGFARAV
B/Brisbane/60/2008	GTTKELVQNTYQWVLKNLVTLKAQFLLGKEDMFQWDAFEAFXSIIIPQKMAGQYSGFARAV
B/Ann Arbor/1/1966	LKQMRDQEVMTDQFIKLLPFCFSPPKLRSN
B/Brisbane/60/2008	LKQMRDQEVMTDQFIKLLPFCFSPPKLRSN
B/Ann Arbor/1/1966	YNPQTEVLTICGRMMSLKKGIEDEERNRSMGNAVLAVGFLVSGKYDPLGDFKTIEELEKL
B/Brisbane/60/2008	YNPQTEVLTICGRMMSLKKGIEDEERNRSMGNAVLAVGFLVSGKYDPLGDFKTIEELEKL
B/Ann Arbor/1/1966	KPGEKANILLYQGKPVKVVKRKRYALSNDISQGIKRQRTVESMGWALS
B/Brisbane/60/2008	KPGEKANILLYQGKPVKVVKRKRYALSNDISQGIKRQRTVESMGWALS

■ = amino acid identical

□ = amino acid changes

■ = amino acid changes present in the cold adapted MDV

Amino acid changes:

R43K	R78Q
K115R	M183I
V291T	I303X
R382K	M383L
K397R	P456S
L468S	V479I
K483R	T492I
E582X	R639K
M641V	

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 PB1

B/Ann Arbor/1/1966	MNINPYFLFIDVPI	QAAISTTFPYTGVPYSHGTGTGYTIDTVIRTHEYSNKGKQYISDV
B/Brisbane/60/2008	MNINPYFLFIDVPI	QAAISTTFPYTGVPYSHGTGTGYTIDTVIRTHEYSNKGKQYISDV
B/Ann Arbor/1/1966	TGCAM	MVDPTNGPLPEDNEPSAYAQLDCVLEALDRMDEEHPGLFQAASQNAMEALMVTTVD
B/Brisbane/60/2008	TGCTM	MVDPTNGPLPEDNEPSAYAQLDCVLEALDRMDEEHPGLFQAASQNAMEALMVTTVD
B/Ann Arbor/1/1966	KLTQGRQTFDWTVCRNQPAATALNTTITSFRLNDLNGADKGG	LVPFCQDIIDS
B/Brisbane/60/2008	KLTQGRQTFDWTVCRNQPAATALNTTITSFRLNDLNGADKGG	LVPFCQDIIDS
B/Ann Arbor/1/1966	FFSVKNIKKKLPAKNRKGFLIKRIPMKVKDR	ITRVEYIKRALSLNTMTKDAERGKLRRA
B/Brisbane/60/2008	FFSVKNIKKKLPAKNRKGFLIKRIPMKVKDK	ITKVEYIKRALSLNTMTKDAERGKLRRA
B/Ann Arbor/1/1966	IATAGIQIRGFVLVVENLAKNICENLEQSGLPVGGNEKKAKLSNAVAKMLSNCPPGGISM	
B/Brisbane/60/2008	IATAGIQIRGFVLVVENLAKNICENLEQSGLPVGGNEKKAKLSNAVAKMLSNCPPGGISM	
B/Ann Arbor/1/1966	TVTGDNTKWNECLNPRIFLAMTERITRDSPI	WFRDFCSIAPVLF
B/Brisbane/60/2008	TVTGDNTKWNECLNPRIFLAMTERITRDSPI	WFRDFCSIAPVLF
B/Ann Arbor/1/1966	TKRLKAQIPCPDLFN	IPLERYNEETRAKLKKLPFFNEEGTASLSPGMMMGMFNM
B/Brisbane/60/2008	TKRLKAQIPCPDLFS	IPLERYNEETRAKLKKLPFFNEEGTASLSPGMMMGMFNM
B/Ann Arbor/1/1966	GVAALGIKNIGNR	EYLWDGLQSSDDFALFVNAKDEETCMEGINDFYRTCKLLG
B/Brisbane/60/2008	GVAALGIKNIGNR	EYLWDGLQSSDDFALFVNAKDEETCMEGINDFYRTCKLLG
B/Ann Arbor/1/1966	SYCNETGMFEFTSMFYRDGFVSNFAMELPSFGVAGVNESADMAIGMTIIKNNMINNGMGP	
B/Brisbane/60/2008	SYCNETGMFEFTSMFYRDGFVSNFAMELPSFGVAGVNESADMAIGMTIIKNNMINNGMGP	
B/Ann Arbor/1/1966	ATAQTAIQLFIADYRYTYKCHRGDSKVEGKRMKIIKELWENTKGRDGLLVADGGPNIIYNL	
B/Brisbane/60/2008	ATAQTAIQLFIADYRYTYKCHRGDSKVEGKRMKIIKELWENTKGRDGLLVADGGPNIIYNL	
B/Ann Arbor/1/1966	RNLHIPEIVLKYNLMDPEYKGRLLHPQNPFVGHLSIEGIKEADITPAHGPI	KKMDYDAVS
B/Brisbane/60/2008	RNLHIPEIVLKYNLMDPEYKGRLLHPQNPFVGHLSIEGIKEADITPAHGPI	KKMDYDAVS
B/Ann Arbor/1/1966	GTHSWRTRKNRSILNTDQRNMILEEQCYAKCCNLFEACFNSASYRKVPVQHSMLEAMAHR	
B/Brisbane/60/2008	GTHSWRTRKNRSILNTDQRNMILEEQCYAKCCNLFEACFNSASYRKVPVQHSMLEAMAHR	
B/Ann Arbor/1/1966	LRMDARLDYESGRMSKDDFEKAMAHLGEIGHI	
B/Brisbane/60/2008	LRMDARLDYESGRMSKDDFEKAMAHLGEIGYI	

 = amino acid identical
 = amino acid changes

Amino acid changes:

I14V	A64T
V164T	K176R
R211K	R214K
I331V	N375S
R433K	I474V
I651V	H751Y

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 PA

B/Ann Arbor/1/1966	MDTFITRNFQTTIIQAKNTMAEFSEDPELQPAMLFNICVHLEVCYVISDMNFLDEEGKT
B/Brisbane/60/2008	MDTFITRNFQTTIIQAKNTMAEFSEDPELQPAMLFNICVHLEVCYVISDMNFLDEEGKA
B/Ann Arbor/1/1966	YTALEGQGKEQNLRPQYEVIEGMPRNIAWMVQRSLAQEHGIETPRYLADLFDYKTKRFIE
B/Brisbane/60/2008	YTALEGQGKEQNLRPQYEVIEGMPRTIAWMVQRSLAQEHGIETPKYLADLFDYKTKRFIE
B/Ann Arbor/1/1966	VGITKGLADDYFWKKKEKLGNSMELMIFSYNQDYSLSNEHSLDEEGKGRVLSRLTELQAE
B/Brisbane/60/2008	VGITKGLADDYFWKKKEKLGNSMELMIFSYNQDYSLSNESLDEEGKGRVLSRLTELQAE
B/Ann Arbor/1/1966	LSLKNLWQVLIGEEDIKKGIDFKLGQTISKLRDISVPAGFSNFEGMRSYIDNIDPKGAIE
B/Brisbane/60/2008	LSLKNLWQVLIGEEDVEKKGIDFKLGQTISRILRDISVPAGFSNFEGMRSYIDNIDPKGAIE
B/Ann Arbor/1/1966	RNLARMSPLVSVTPKKLKWEDLRPIGPHIYSHELPEVPYNAFLIMSDELGLANMTEGSKS
B/Brisbane/60/2008	RNLARMSPLVSVTPKKLTWEDLRPIGPHIYDHELPEVPYNAFLIMSDELGLANMTEGSKS
B/Ann Arbor/1/1966	KPKTLAKECLEKYSTLRDQTDPIILIMKSEKANENFLWKLWRDCVNTISNEETSNELQKTN
B/Brisbane/60/2008	KPKTLAKECLEKYSTLRDQTDPIILIMKSEKANENFLWKLWRDCVNTISNEETSNELQKTN
B/Ann Arbor/1/1966	YAKWATGDGLTYQKIMKEVAIDDETMYYQEEPkipNKRVAAWVQTEMNLLSTLTskRALD
B/Brisbane/60/2008	YAKWATGDGLTYQKIMKEVAIDDETMCYQEEPkipNKRVAAWVQTEMNLLSTLTskRALD
B/Ann Arbor/1/1966	LPEIGPDVAPVEHVGSERRKYFVNEINYCKASTVMMKYVLFHTSLLNESNASMGKYKVIP
B/Brisbane/60/2008	LPEIGPDIAPVEHVGSERRKYFVNEINYCKASTVMMKYVLFHTSLLNESNASMGKYKVIP
B/Ann Arbor/1/1966	ITNRVVNEKGESFDIILYGLAVKGQSHLRGDTDVVTVVTFEFSSTDPRVDSGKWPKYTVFR
B/Brisbane/60/2008	ITNRVVNEKGESFDMLYGLAVKGQSHLRGDTDVVTVVTFEFSSTDPRVDSGKWPKYTVFR
B/Ann Arbor/1/1966	IGSLFVSGREKSVYLYCRVNGTNKIQMKWGMEARRCLLQSMQOMEAIVDQESSIQGYDMT
B/Brisbane/60/2008	IGSLFVSGREKSVYLYCRVNGTNKIQMKWGMEARRCLLQSMQOMEAIVEQESSIQGYDMT
B/Ann Arbor/1/1966	KACFKGDRVNSPKTFSIGTQEGKLVKGSFGKALRVIFTKCLMHYVFGNAQLEGFSAESRR
B/Brisbane/60/2008	KACFKGDRVNSPKTFSIGTQEGKLVKGSFGKALRVIFTKCLMHYVFGNAQLEGFSAESRR
B/Ann Arbor/1/1966	LLLLIQALKDRKGPWFVDLEGMYSGIEECISNNPWVIQSAVYWFNEWLGFEKEGSKVLESI
B/Brisbane/60/2008	LLLLIQALKDRKGPWFVDLEGMYSGIEECISNNPWVIQSVYWFNEWLGFEKEGNKVLESV
B/Ann Arbor/1/1966	DEIMDE
B/Brisbane/60/2008	DEIMDE

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Amino acid changes:

T60A	N86T
R105K	H160S
I196V	K210R
K258T	S271D
Y387C	V428I
D589E	A700V
S714N	I720V

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 NP

B/Ann Arbor/1/1966	MSNMIDIDGINTGTIDKTPEEITSGTSGATRPIIKPATLAPPSNKRTRNPSPERATTSSSEA
B/Brisbane/60/2008	MSNMIDIDGINTGTIDKTPEEITSGTSGTTRPIIRPATLAPPSNKRTRNPSPERATTSSSED
B/Ann Arbor/1/1966	IVGRRITQKKQTPTEIKKSVYNMVKLGEFYNQMMVKAGLNDDMERNLIQNAHAVERILLA
B/Brisbane/60/2008	DVGRKITQKKQTPTEIKKSVYNMVKLGEFYNQMMVKAGLNDDMERNLIQNAHAERILLA
B/Ann Arbor/1/1966	ATDDKKTEYQKKKNARDVKEGKEEIDHNKTGGTFYKMRDDKTIYFSPIRITFLKEEVKT
B/Brisbane/60/2008	ATDDKKTEFQKKKNARDVKEGKEEIDHNKTGGTFYKMRDDKTIYFSPIRITFLKEEVKT
B/Ann Arbor/1/1966	MYKTTMGSDGFSGLNHIMIGHSQMNDVCFQRSKALKRVGLDPSLISTFAGSTLPRRSGAT
B/Brisbane/60/2008	MYKTTMGSDGFSGLNHIMIGHSQMNDVCFQRSKALKRVGLDPSLISTFAGSTVPRRSGAT
B/Ann Arbor/1/1966	GVAIKGGGTLVAEAIRFIGRAMADRGLLRDIRAKTAYEKILLNLKNKCSAPQQKALVDQV
B/Brisbane/60/2008	GVAIKGGGTLVAEAIRFIGRAMADRGLLRDIKAKTAYEKILLNLKNKCSAPQQKALVDQV
B/Ann Arbor/1/1966	IGSRNPGIADIEDLTLLARSMVVVRPSVASKVVLPIISINAKIPQLGFNVEEYSMVGYEAM
B/Brisbane/60/2008	IGSRNPGIADIEDLTLLARSMVVVRPSVASKVVLPISIYAKIPQLGFNVEEYSMVGYEAM
B/Ann Arbor/1/1966	ALYNMATPVSILRMGDDAKDKSQLFFMSCFGAAYEDQRVLSALTGTEFKPRSALKCKGFH
B/Brisbane/60/2008	ALYNMATPVSILRMGDDAKDKSQLFFMSCFGAAYEDLRVLSALTGTEFKPRSALKCKGFH
B/Ann Arbor/1/1966	VPAKEQVEGMGAALMSIKLQFWAPMTRSGGNEVGGDGGSGQISCSPVFAVERPIALSKQA
B/Brisbane/60/2008	VPAKEQVEGMGAALMSIKLQFWAPMTRSGGNEVGGDGGSGQISCSPVFAVERPIALSKQA
B/Ann Arbor/1/1966	VRRMLSMNIEGRDADVKGNNLLKMMNDSMAKKTN
B/Brisbane/60/2008	VRRMLSMNIEGRDADVKGNNLLKMMNDSMAKKTS
B/Ann Arbor/1/1966	TIPNFFFGRDTAEDYDDL
B/Brisbane/60/2008	TIPNFFFGRDTAEDYDDL

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Amino acid changes:

A28T	K34R
A60D	I61D
R65K	V114A
Y129E	L233V
R272K	N339Y
Q397L	N513S
I531T	V534I
D535E	

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 M1

B/Ann Arbor/1/1966	MSLFGDTIAYLLSLTEDGEGKAELAELKLCWFGGKEFDLDSALEWIKNKRCLTDIQKALI
B/Brisbane/60/2008	MSLFGDTIAYLLSLTEDGEGKAELAELKLCWFGGKEFDLDSALEWIKNKRCLTDIQKALI
B/Ann Arbor/1/1966	GASICFLKPKDQERKRRFITEPLSGMGTTATKKKGLILAERKMRRCVSFHEAFEIAEGHE
B/Brisbane/60/2008	GASICFLKPKDQERKRRFITEPLSGMGTTATKKKGLILAERKMRRCVSFHEAFEIAEGHE
B/Ann Arbor/1/1966	SSALLYCLMVMYLNPGNYSMQVKLGTLCALCEKQASHSHRAHSRAARSSVPGVRREMOMV
B/Brisbane/60/2008	SSALLYCLMVMYLNPGNYSMQVKLGTLCALCEKQASHSHRAHSRAARSSVPGVRREMOMV
B/Ann Arbor/1/1966	SAMNTAKTMNGMGKGEDVQKLAEEQLSNIGVLRSLGASQKNAGEGIAKDVMEVLKQSSMGN
B/Brisbane/60/2008	SAMNTAKTMNGMGKGEDVQKLAEEQLSNIGVLRSLGASQKNAGEGIAKDVMEVLKQSSMGN
B/Ann Arbor/1/1966	SALVKKYL
B/Brisbane/60/2008	SALVKKYL

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Amino acid changes:

None

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 M2

B/Ann Arbor/1/1966	MLEPFQILS	ICSFILSALHFM	AWTIGHLNQIKRGV	NL	KIRIRN	PNKETINREVSILRHSY
B/Brisbane/60/2008	MLEPFQILT	ICSFILSALHFM	AWTIGHLNQIKRG	IN	MKIRIKG	PNKETINREVSILRHSY

B/Ann Arbor/1/1966	QKEIQAKETMKEVLSDNMEI	ILSDHIV	IEGLSAEEIIKMGETVLEVEELQ		
B/Brisbane/60/2008	QKEIQAKETMKEVLSDNMEV	LN	DHII	IEGLSAEEIIKMGETVLEI	EELH

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Amino acid changes:

S9T	V35I
L37M	R42K
N43G	I80V
S82N	V86I
V105I	Q109H

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 NS1

B/Ann Arbor/1/1966	MAD-NMTTQTQIEVGPGATNATINFEAGILECYERLSSQRALDYPGQDRNLRLKRLKLESRI
B/Brisbane/60/2008	MANN-NMTTQTQIEVGPGATNATINFEAGILECYERLSWQRALDYPGQDRNLRLKRLKLESRI
B/Ann Arbor/1/1966	KTHNKSEPESEKSRMSLEERKAIGVKMMKVLLFMNPSAGIEGFEPYCMKNSSNSNCPNCNWT
B/Brisbane/60/2008	KTHNKSEPESEKSRMSLEERKAIGVKMMKVLLFMNPSAGIEGFEPYCMKSSNSNCTKYNWT
B/Ann Arbor/1/1966	DYPPTPGKCLDDIEEEPENVDDPTEIVLRDMNNKDARQKIKEEVNTQKEGKFRLTIKRDI
B/Brisbane/60/2008	DYPSTPERCLDDIEEEPEDVDGPTEIVLRDMNNKDARQKIKEEVNTQKEGKFRLTIKRDM
B/Ann Arbor/1/1966	RNVLSLRVLVNGTFLKHPNGYKSLSTLHRLNAYDQSGRLVAKLVATDDLTVEDEEDGHRI
B/Brisbane/60/2008	RNVLSLRVLVNGTFLKHPNGHKSLSTLHRLNAYDQSGRLVAKLVATDDLTVEDEEDGHRI
B/Ann Arbor/1/1966	LNSLFERFNEGHSKPIRAAETAVGVLSQFGQEHRLSPEEGDN
B/Brisbane/60/2008	LNSLFERLNEGHSKPIRAAETAVGVLSQFGQEHRLSPEEGDN

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Amino acid changes:

D3N	Δ4N
S37W	N107S
P114T	N115K
C116Y	P123S
G126E	K127R
N138D	D141G
Y200H	F247L

Amino acid alignment of B/Ann Arbor/1/1966 and B/Brisbane/60/2008 NEP

B/Ann Arbor/1/1966	MAD-NMTTTQIEWRMKKMAIGSSTHSSSVLMKDIIQSQFEQLKLRWESYPNLVKSTDYHQR
B/Brisbane/60/2008	MANNNMNTTTQIEWRMKKMAIGSSTHSSSVLMKDIIQSQFEQLKLRWESYPNLVKSTDYHQK
B/Ann Arbor/1/1966	RETIRLVTEELYLLSKRIDDNILFHKTIVIANSSIIADMTIVSLSLLETLYEMKDVVEVYSR
B/Brisbane/60/2008	RETIRLVTEELYLLSKRIDDNILFHKTIVIANSSIIADMTVVSLSLLETLYEMKDVVEVYSR
B/Ann Arbor/1/1966	QCL
B/Brisbane/60/2008	QCL

 = amino acid identical
 = amino acid changes

Amino acid changes:

D3N	Δ4N
R60K	I99V