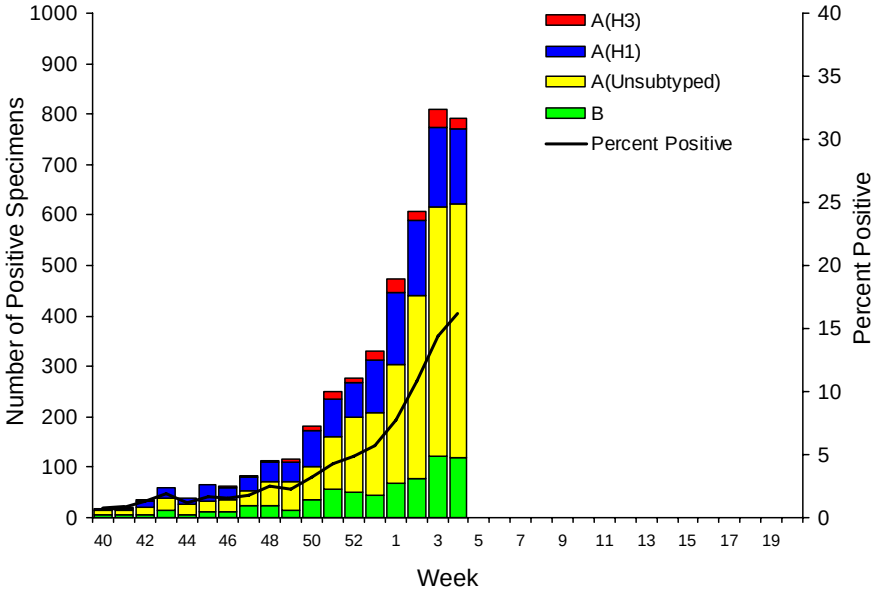
FEBRUARY 18-19 VRPBAC MEETING
Briefing materials

Influenza Division
National Center for Immunization and Respiratory Diseases
Coordinating Center for Infectious Diseases
Centers for Disease Control and Prevention
Atlanta, GA 30333

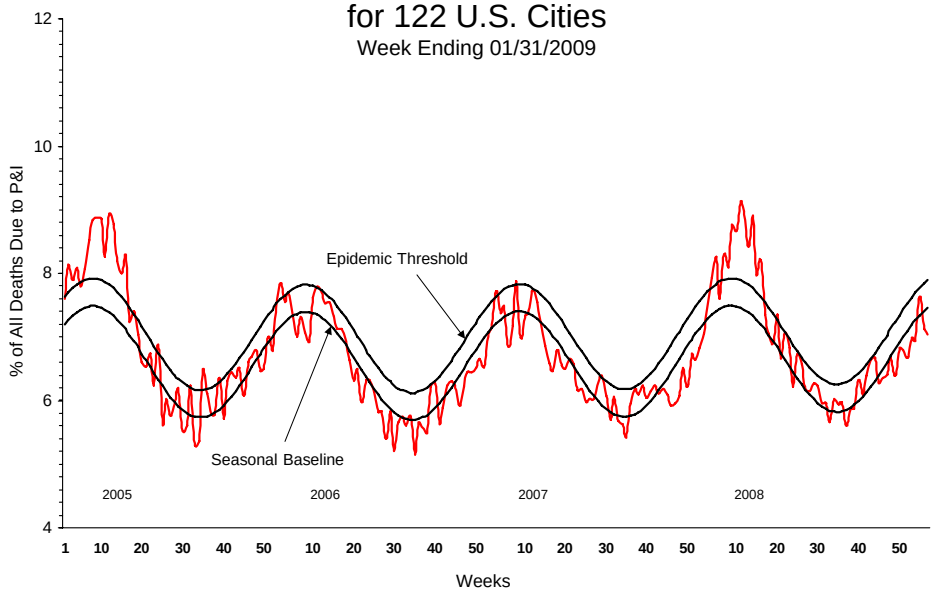
U.S. Surveillance

Influenza Positive Tests Reported to CDC by U.S. WHO/NREVSS Collaborating Laboratories, National Summary, 2008-09

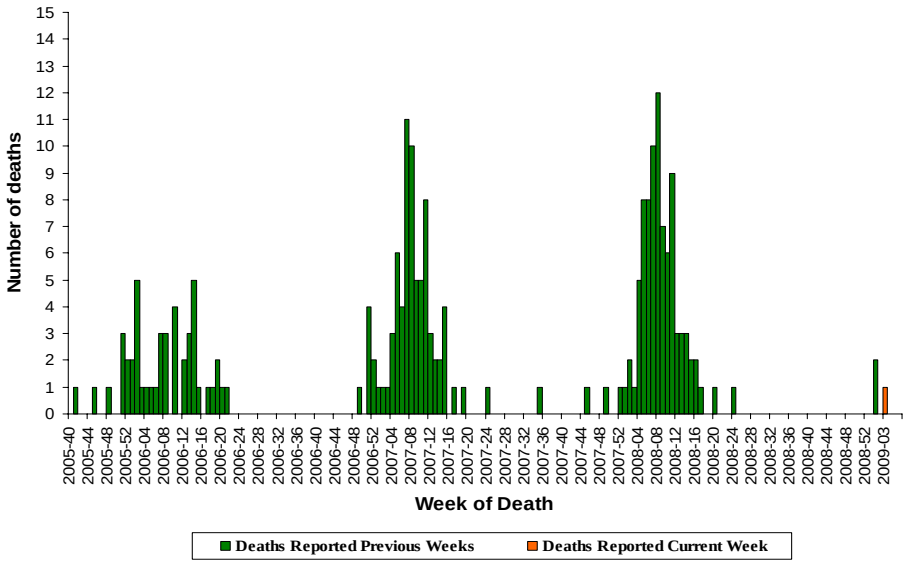


Pneumonia and Influenza Mortality for 122 U.S. Cities

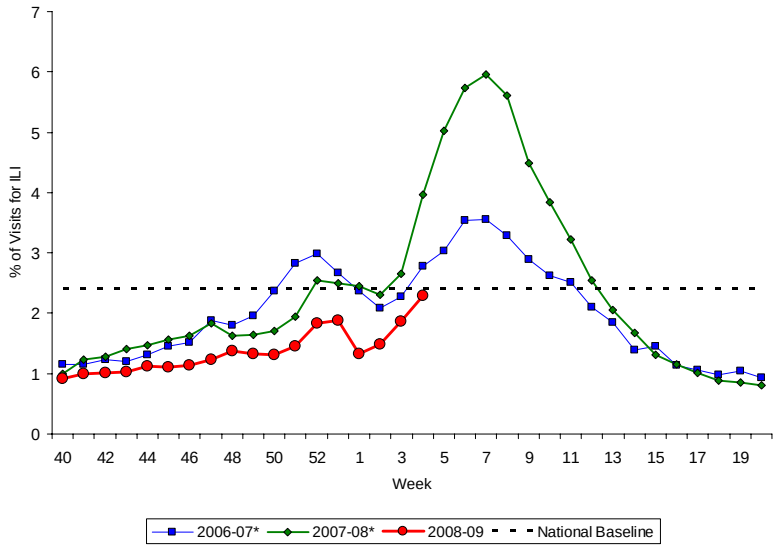
Week Ending 01/31/2009



Number of Influenza-Associated Pediatric Deaths by Week of Death:
2005-06 season to present

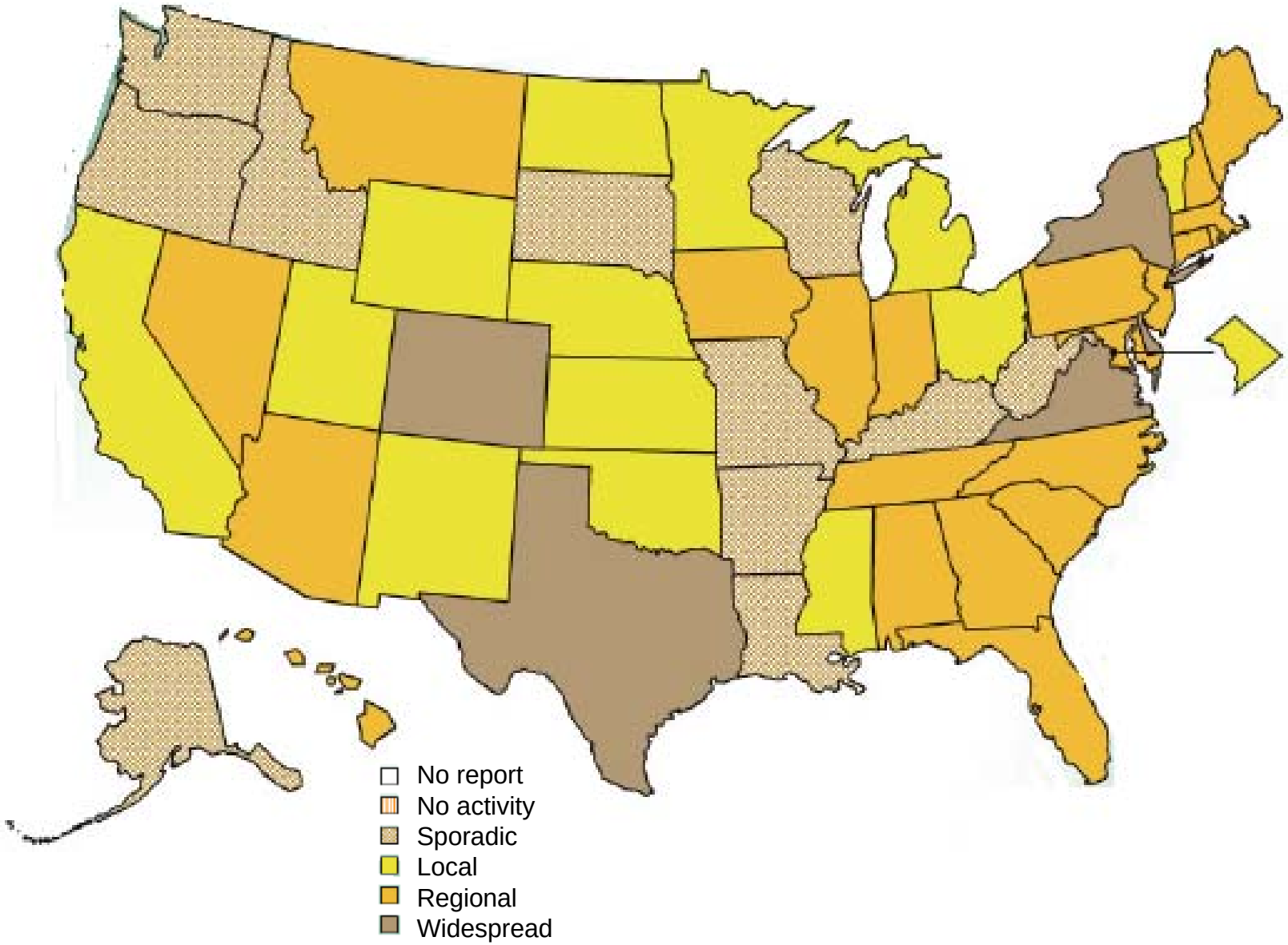


Percentage of Visits for Influenza-like Illness (ILI) Reported by the US Outpatient Influenza-like Illness Surveillance Network (ILINet), National Summary 2008-09 and Previous Two Seasons



*There was no week 53 during the 2006-07 and 2007-08 seasons, therefore the week 53 data point for those seasons is an average of weeks 52 and 1.

Influenza Activity: Week Ending January 31 – (Week 4)



Summary

- Influenza activity continues to increase in many countries of the world. During the current influenza season in the northern hemisphere:

    - in Europe, 91% of influenza viruses identified were A(H3N2), 6% were A(H1N1) and 3% were influenza B.
    - in Japan, 44% of influenza viruses isolated so far were A(H1N1), 41% were A(H3N2) and 15% were influenza B (77% belonging to the B/Victoria lineage).
    - in China and South Korea, the majority of isolates were of the A(H1N1) subtype.
    - in the U.S., influenza A(H1N1) viruses continued to predominate (73%) with co-circulation of influenza A(H3N2) (11%) and B (16%) viruses (~60% B/Victoria-lineage).

- The majority of influenza **A(H1N1) viruses** characterized have been antigenically closely related to the current A/Brisbane/59/2007 vaccine virus. The HA genes of the majority of H1N1 viruses sequenced so far fall into clade 2B. Recent clade 2B viruses share an amino acid substitution A189T (A193T in H3 numbering) in HA and most share the H275Y (H274Y in N2 numbering) mutation in the NA, indicative of resistance to oseltamivir. Oseltamivir-resistant viruses remain sensitive to zanamivir as well as amantadine/rimantadine, and are antigenically indistinguishable from oseltamivir-sensitive viruses. HA gene sequences of recent H1N1 viruses isolated in China fall within clade 2C and these viruses are similar antigenically to clade 2B viruses. Most isolates with HA sequences in clade 2C are sensitive to oseltamivir and zanamivir and resistant to amantadine/rimantadine.

- Over the past several months, the majority of **influenza A(H3N2)** viruses characterized were antigenically similar to the A/Brisbane/10/2007 and A/Uruguay/716/2007 vaccine viruses. A proportion of H3N2 viruses showed reduced titers to ferret antisera raised against egg-grown A/Brisbane/10/2007 and/or A/Uruguay/716/2007 in HI tests (low reactors). However, neutralization tests revealed that representative low reactors were neutralized by ferret antisera raised against A/Brisbane/10/2007, A/Uruguay/716/2007 and other recent reference viruses, indicating that such viruses were antigenically similar to the current vaccine viruses. Phylogenetic analysis of HA sequences demonstrated that most recent A(H3N2) viruses fall into the A/Brisbane/10/2007 clade, with signature changes at G50E and K140I. As previously noted, genetic heterogeneity among the HAs of A/Brisbane/10/2007-like viruses separate them into 3 subclades with K173N, K173Q or L157S mutations; K173Q change predominates in most recent isolates. There was no correlation between HA sequences of viruses that had lower HI titers with antiserum against the vaccine viruses and any particular subclade or amino acid change. Almost all recent H3N2 viruses are resistant to amantadine/rimantadine.

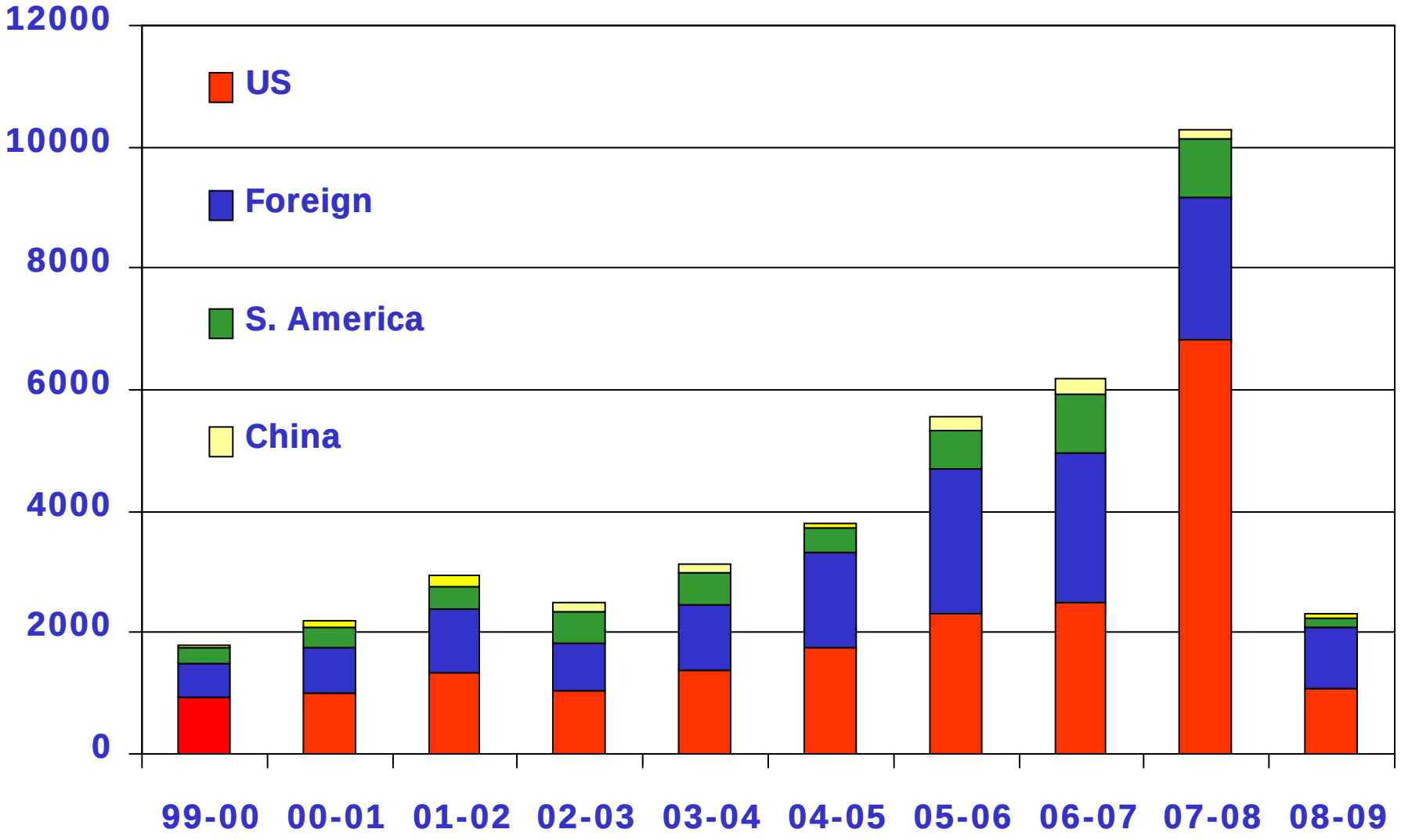
- **Influenza B** viruses of both lineages have been isolated worldwide. Influenza B viruses of both the B/Yamagata/16/88 and the B/Victoria/2/87 lineages continued to co-circulate. The proportion of B/Victoria/2/87 lineage viruses has continued to increase and these viruses have become predominant in many countries.

- The haemagglutinins of the **B/Victoria/2/87** lineage viruses are in four main phylogenetic clades represented by B/Brisbane/60/2008, B/Townsville/2/2008, B/Hubei-Songzi/51/2008, and B/Bangladesh/4008/2008. Strains in all four clades were antigenically distinguishable from the previous B/Victoria lineage vaccine strainB/Malaysia/2506/2004. The B/Brisbane/60/2008 and B/Townsville/2/2008 clades formed one antigenic cluster represented by B/Brisbane/60/2008. The B/Hubei-Songzi/51/2008 and B/Bangladesh/4008/2008 clades formed another antigenic cluster represented by B/Hubei-Songzi/51/2008. Viruses in the B/Brisbane/60/2008 cluster were more antigenically distinct from the B/Malaysia/2506/2004-like strains than viruses in the B/Hubei-Songzi/51/2008 cluster. Most recent isolates from Europe, Oceania, North America

and South America were in the B/Brisbane/60/2008 antigenic cluster. Currently, B/Hubei-Songzi/51/2008 clade viruses are predominant in China.

- In HI tests with postinfection ferret sera the majority of viruses of the **B/Yamagata/16/88** lineage were closely related to the vaccine strains B/Florida/4/2006 and B/Brisbane/3/2007. The haemagglutinins of the B/Yamagata/16/88 lineage viruses fell into three clades represented by B/Florida/4/2006, B/Brisbane/3/2007 or B/Bangladesh/3333/2007, with the B/Bangladesh/3333/2007 clade predominating. These three clades were antigenically indistinguishable.

Specimens Received by CDC



02/05/2009

Countries of Origin of Isolates Characterized by CDC

Month of Collection	H1N1		H3		B/Victoria		B/Yamagata	
July, 2008	Argentina	21	Australia	1	Australia	1	Argentina	7
	Australia	1	Guatemala	1	Brazil	12	Australia	1
	Brazil	4	Hong Kong	3	Hong Kong	1	Bolivia	2
	Chile	2	India	7	India	6	Brazil	8
	Costa Rica	1	Kenya	25	Kenya	1	El Salvador	11
	El Salvador	20	New Zealand	2	Paraguay	2	Guatemala	2
	Guatemala	1	United States	1	Peru	1	Hong Kong	2
	Honduras	4			Uruguay	2	India	2
	Hong Kong	6					Kenya	17
	Kenya	8					Mauritius	1
	Paraguay	1					Mexico	1
	Peru	3					New Zealand	2
	United States	2					Paraguay	3
	Uruguay	8					Peru	1
							Singapore	1
							United States	2
							Uruguay	1
August, 2008	Brazil	1	Kenya	7	Australia	1	Brazil	2
	El Salvador	4	New Zealand	3	Brazil	3	El Salvador	5
	Kenya	1	Taiwan	1	India	11	India	3
	New Zealand	2	United States	6	New Zealand	5	Kenya	2
	Singapore	2			Paraguay	1	New Zealand	2
	United States	4					Saint Lucia	2
	Venezuela	1					United States	5
	Vietnam	1						
September, 2008	Mexico	3	Ecuador	1	Brazil	3	Brazil	9
	Singapore	2	Hong Kong	1	India	4	Hong Kong	1
	United States	1	Mauritius	1	New Zealand	5	India	2
			United Kingdom	1	United States	1	Mexico	1
			United States	4			Taiwan	2
							United States	3
October, 2008	China	16	Guam	1	China	3	Bolivia	1
	Ecuador	1	Hong Kong	2	Costa Rica	1	Costa Rica	1
	Mexico	4	India	1	Germany	1	Guam	4
	Taiwan	1	Taiwan	4	India	4	Honduras	3
	United States	28	United States	6	United States	7	Hong Kong	1
							Mexico	1
							Taiwan	1
							United States	6
November, 2008	China	7	Norway	1	China	2	Bolivia	1
	Costa Rica	1	Taiwan	1	Hong Kong	1	China	1
	Hong Kong	1	Thailand	3	India	2	Hong Kong	1
	Mexico	1	United States	6	Japan	1	Singapore	1
	Singapore	1			United States	17	Taiwan	1
	United States	45					Thailand	1
							United States	9
December, 2008	Hong Kong	2	United States	25	Hong Kong	1	India	1
	Taiwan	3			United States	26	Thailand	1
	United States	76					United States	13
January, 2009	United States	1			United States	5		
Total		**292**		**115**		**131**		**151**

Influenza A(H1N1) Viruses

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA H1 VIRUSES (01/09/09)

		REFERENCE FERRET ANTISERA									
		1	2A	2B	2B	2B	2C	2C	2C	Date	
	REFERENCE ANTIGENS	FL/3	SI/3	AS/59	IVR-148	SD/6	HK/2652	AS/200	HK/1870	collected	Passage
1	A/FLORIDA/03/2006	640	80	80	160	80	160	40	80	10/31/06	E3
2	A/SOLOMON ISLANDS/03/2006	5	320	80	320	160	640	160	160	08/21/06	E2/E2
3	A/BRISBANE/59/2007*	5	320	320	640	320	320	320	320	07/01/07	E2/E1
4	A/BRISBANE/59/2007 IVR-148	5	320	320	1280	640	640	320	320	REASS	EX/E2
5	A/SOUTH DAKOTA/06/2007	5	160	160	640	320	320	160	320	07/17/07	E3
6	A/HONG KONG/2652/2006	5	320	320	640	320	1280	640	640	07/17/06	E3
7	A/PERTH/200/2008*	5	640	320	640	320	1280	640	640	02/22/08	E3/E2
8	A/HONG KONG/1870/2008 E*	5	160	320	640	320	640	320	640	07/26/08	E4
	TEST ANTIGENS										
9	A/WASHINGTON/10/2008	5	640	640	1280	320	1280	640	640	11/08/08	CX/C1
10	A/NEBRASKA/07/2008	20	160	320	320	320	320	160	160	12/04/08	M1/C1
11	A/ALASKA/05/2008	10	160	320	640	320	320	160	320	12/10/08	M1/C1
12	A/NEW JERSEY/23/2008	5	160	320	640	320	320	160	160	12/22/08	MX/C1
13	A/VIRGINIA/06/2008	5	80	160	320	320	320	160	160	12/10/08	M1/C1
14	A/FLORIDA/27/2008	5	80	160	320	160	160	80	160	12/12/08	MX/C1
15	A/PENNSYLVANIA/10/2008	5	80	160	320	160	160	160	160	12/12/08	X/C1
16	A/IDAHO/23/2008	10	80	160	320	320	160	80	160	12/24/08	M1/C1
17	A/MARYLAND/05/2008	10	80	160	320	160	160	80	160	12/10/08	M1/C1
18	A/ARIZONA/16/2008	5	80	160	320	160	320	80	160	12/12/08	CX/C1
19	A/NORTH DAKOTA/01/2008	20	80	160	320	160	320	160	160	12/12/08	M2/C1
20	A/ARIZONA/13/2008	5	80	160	320	160	80	80	80	11/16/08	E2
21	A/TENNESSEE/11/2008	5	80	160	160	80	80	40	40	12/04/08	X/C1
22	A/SOUTH CAROLINA/06/2008	5	80	80	160	80	320	80	80	10/22/08	E2
23	A/TIANJIN/JINNAN1158/2008	5	160	320	640	160	640	320	640	10/14/08	C1/C1
24	A/HUNAN/FURONG1295/2008	5	160	320	640	160	640	320	320	10/20/08	C2/C1
25	A/SHANGHAI/NANHUI1167/2008	5	640	320	640	160	640	640	640	10/24/08	C1/C1
26	A/BEIJING/HUAIROU190/2008	5	640	320	1280	320	640	640	640	11/21/08	C1/C1
27	A/JILIN/CHAOYANG1258/2008	5	160	320	640	320	320	160	160	11/27/08	C1/C1
28	A/JILIN/NANGUAN190/2008	5	160	320	640	320	160	80	160	11/08/08	C2/C1
29	A/SHANDONG/LIXIA159/2008	5	320	320	640	320	640	320	320	10/28/08	C3/C1
30	A/TIANJIN/HEDONG1204/2008	10	160	160	320	160	320	160	160	10/14/08	C1/C1
31	A/JILIN/CHAOYANG1188/2008	5	80	160	320	160	160	80	160	11/10/08	C1/C1
32	A/ANHUI/BAOHE1514/2008	5	80	80	160	80	320	160	160	10/23/08	C3/C1
33	A/ANHUI/LUYANG171/2008	5	40	80	160	80	80	80	160	10/27/08	C2/C1
34	A/SHANXI/WEICHENG157/2008	5	40	80	160	80	160	160	160	11/03/08	C2/C1

*Serology antigens

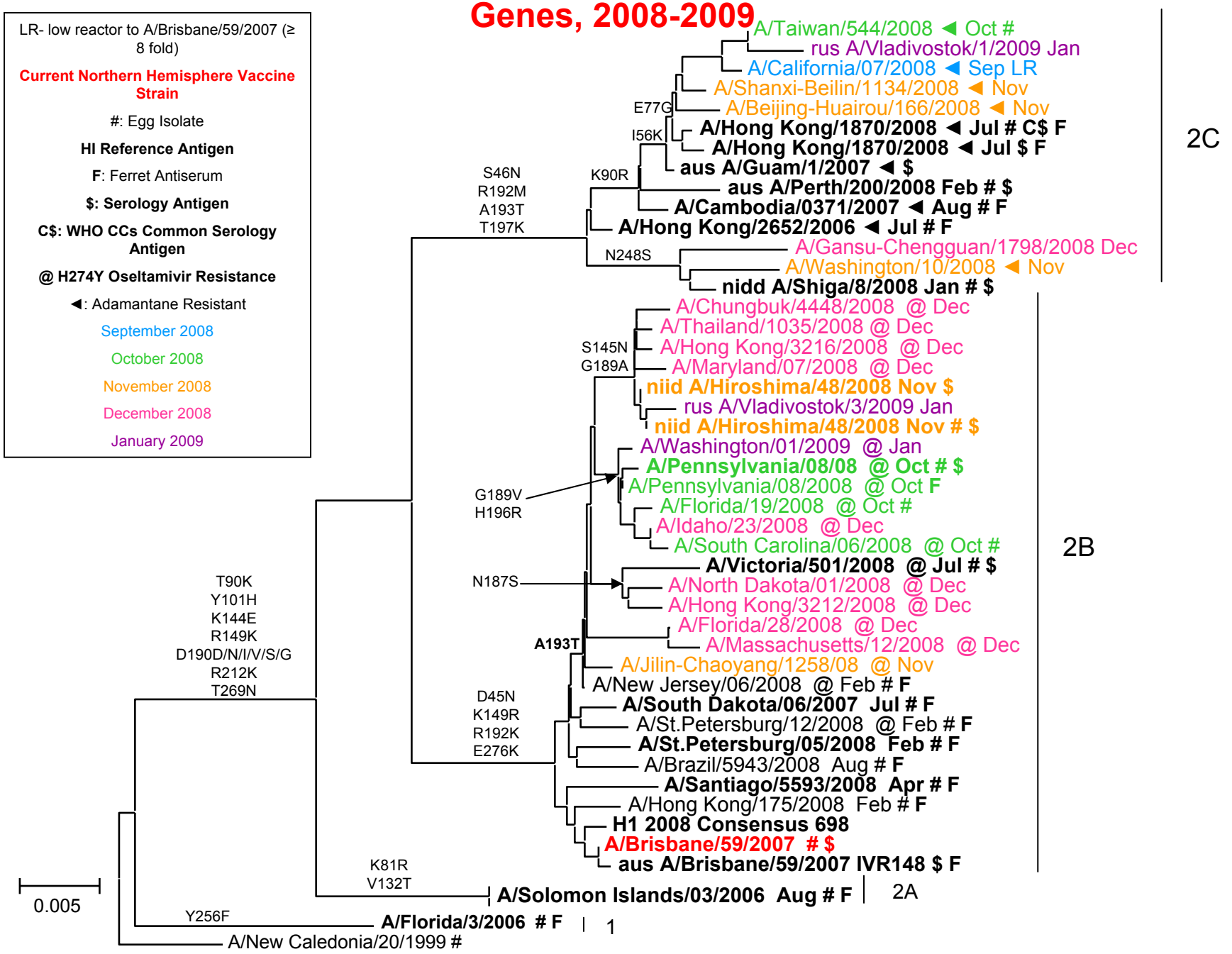
Influenza A(H1N1) Isolates Characterized by CDC

	U.S.A.	North America	Europe	Asia	Cent/So America	Africa, Australia, New Zealand	Total (%)
April 2007 – September 2007							
A/N.Caledonia/20/99-like	5	7	11	5	14	1	43 (21%)
A/Sol. Islands/03/2006-like*	24	1	5	94	6	6	136 (67%)
A/Sol. Islands/03/2006-like**	1	1		5	3	4	14 (7%)
A/Sol. Islands/03/2006 (low)***		2		7		2	11 (5%)
						Total	204
October 2007- March 2008							
A/N.Caledonia/20/99-like					2		2 (0.2%)
A/Sol. Islands/03/2006-like*&**	304	20	22	37	1	3	387 (48%)
A/Sol. Islands/03/2006 (low)***	9		2	2		1	14 (1.6%)
A/Brisbane/59/2007-like*&**	169	27	76	76	29	25	402 (49%)
A/Brisbane/59/2007-like***	1		2	6	2		11 (1.2%)
						Total	816
April 2008 – September 2008							
A/Brisbane/59/2007-like*	4	3	19	45	190	14	275 (80%)
A/Brisbane/59/2007-like**	3			3	45	7	58 (17%)
A/Brisbane/59/2007 (low)***	1			3	6		10 (3%)
						Total	343
October 2008 – January 2009							
A/Brisbane/59/2007-like*	125	4		22	1		152 (85%)
A/Brisbane/59/2007-like**	17	1		9			27 (15%)
						Total	179
Total	**663**	**66**	**137**	**314**	**299**	**63**	**1542**

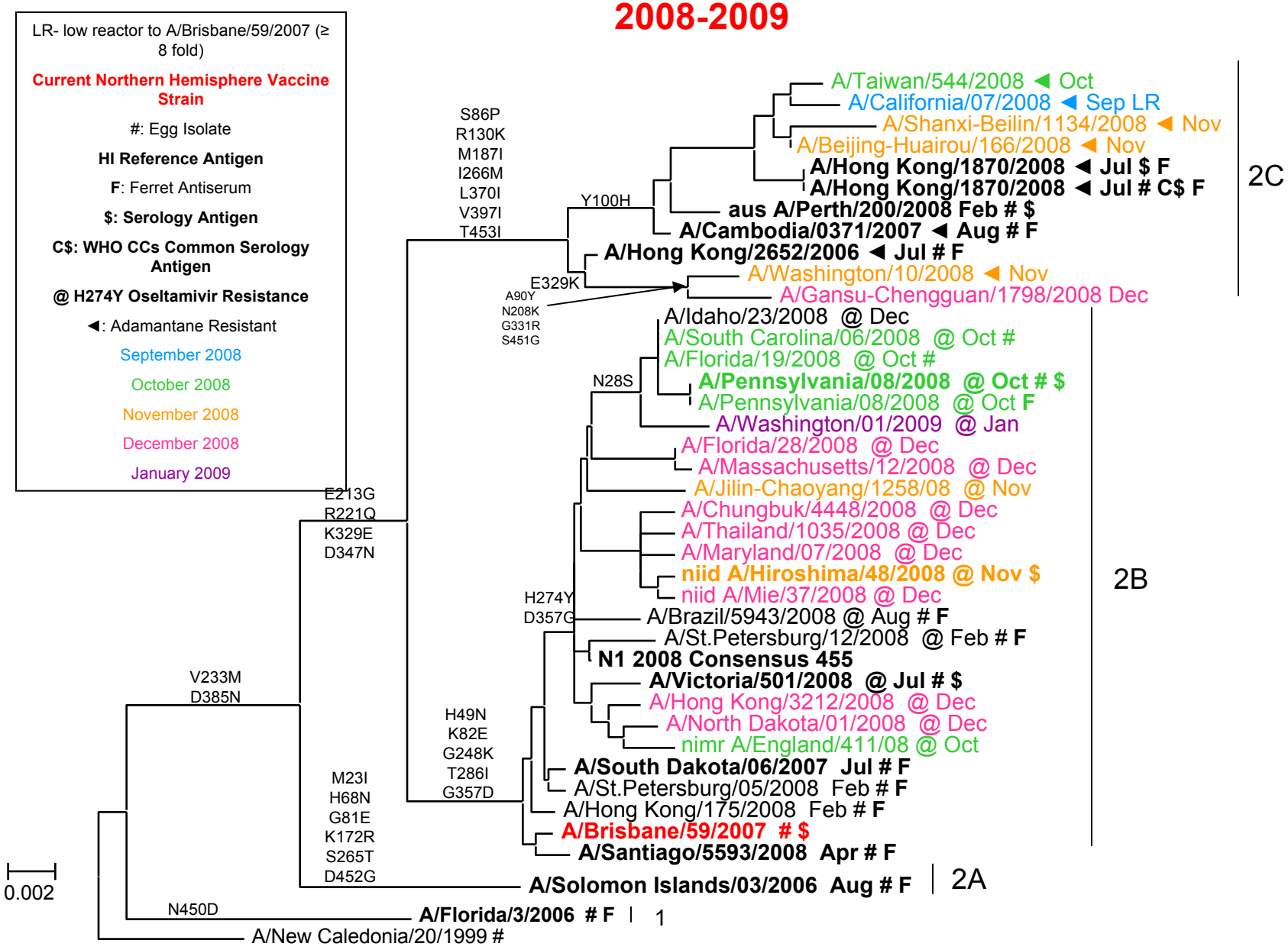
* ≤ 2-fold low to vaccine strain
** = 4-fold low to vaccine strain
*** ≥ 8-fold low to vaccine strain

Preliminary Data 01/22/09

Evolutionary Relationships Among Influenza A (H1N1) Hemagglutinin (HA1) Genes, 2008-2009



Evolutionary Relationships Among Influenza A (H1N1) Neuraminidase Genes, 2008-2009



Influenza A(H3N2) Viruses

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA H3 VIRUSES (01/28/09)

		REFERENCE FERRET ANTISERA												
				Clade 2							Clade 1			
				BRIS/10								BC	Date	
	REFERENCE ANTIGENS	WY/3	WI/67	AS/10	UY/E	UY/M	MS/4	NY/9	MO/E	MO/M	AS/24	CN/1287	Collected	Passage
1	A/WYOMING/03/2003	5120	640	640	320	640	640	640	320	640	80	10	02/13/03	SpfCK2E3
2	A/WISCONSIN/67/2005	160	2560	1280	1280	1280	1280	1280	1280	1280	160	320	08/31/05	SpfCK3E4
3	A/BRISBANE/10/2007	160	1280	640	640	640	640	640	640	640	160	320	02/06/07	E2/E2
4	A/URUGUAY/716/2007*	80	640	640	640	640	320	640	320	640	80	160	06/21/07	SPFCK1E4
5	A/URUGUAY/716/2007 (MDCK)	40	80	320	160	320	160	80	160	320	40	10	06/21/07	C1/C3
6	A/MISSISSIPPI/04/2008	80	1280	1280	320	320	1280	320	1280	640	80	320	01/15/08	E5/E2
7	A/NEW YORK/09/2008*	40	80	160	160	320	160	320	320	640	80	160	04/21/08	M1/C2
8	A/MISSOURI/05/2008* EGG	20	640	640	320	160	640	160	640	320	40	160	02/26/08	E5
9	A/MISSOURI/05/2008 (MDCK)	40	80	160	80	320	160	80	160	320	40	10	02/26/08	M1/C3
10	A/BRISBANE/24/2008*	160	2560	1280	1280	1280	2560	2560	2560	2560	320	320	06/23/08	E5/E2
11	A/BRITISH COLUMBIA/RV1287/2007	40	40	160	160	320	160	80	160	320	40	320	09/27/07	C1/C5
	TEST ANTIGENS													
12	A/COLORADO/09/2008	20	160	320	320	640	160	160	160	640	80	80	10/15/08	X2/C2
13	A/COLORADO/10/2008	40	160	320	320	320	320	320	320	320	80	160	12/20/08	X2/C1
14	A/COLORADO/12/2008	40	160	320	160	320	320	160	160	320	80	40	12/17/08	X2/C2
15	A/MASSACHUSETTS/13/2008	40	160	320	320	640	320	320	320	640	80	80	12/12/08	M1/C1
16	A/MICHIGAN/09/2008	40	320	320	320	320	80	80	80	320	40	10	12/18/08	M1/C1
17	A/MINNESOTA/36/2008	40	80	320	160	320	320	160	160	320	80	20	12/28/08	M1/C2
18	A/NORTH CAROLINA/08/2008	40	320	320	320	640	160	160	320	640	80	10	12/29/08	M1/C1
19	A/NEVADA/02/2008	20	160	320	160	320	160	80	80	160	40	5	12/16/08	X/C1
20	A/PENNSYLVANIA/13/2008	40	320	320	320	320	320	320	320	1280	40	80	12/11/08	C1
21	A/TEXAS/39/2008	40	160	320	320	320	320	320	320	640	80	160	12/26/08	M1/C2
22	A/WISCONSIN/24/2008	320	320	320	320	640	640	320	320	640	80	5	12/23/08	X/C1
23	A/CALIFORNIA/10/2008	20	80	160	160	320	160	160	160	160	40	5	12/20/08	C2/C1
24	ACOLORADO/15/2008	20	40	160	160	160	80	80	80	160	40	10	12/24/08	X2/C2
25	A/COLORADO/11/2008	20	160	160	160	320	160	160	160	320	80	5	11/27/08	X3/C2
26	A/NORTH DAKOTA/02/2008	20	160	160	160	320	160	160	160	320	80	5	12/15/08	M2/C1
27	A/WISCONSIN/23/2008	20	80	160	80	160	160	80	160	320	40	5	12/25/08	C1/C1
28	A/ENGLAND/394/2008	20	80	160	160	320	160	160	160	320	80	320	09/22/08	S4,C4/C1
29	A/HONG KONG/3125/2008	80	320	640	640	640	320	640	320	640	80	320	10/02/08	C2/C1
30	A/HONG KONG/3134/2008	80	320	640	640	1280	640	640	640	1280	160	320	10/08/08	C2/C2
31	A/SINGAPORE/29/2008	40	320	320	160	320	160	80	160	320	80	5	06/25/08	C1/C2
32	A/GUAM/7124/2008	20	80	160	80	160	80	80	80	160	40	20	10/27/08	X/C2
33	A/INDIA/7277/2008	20	80	160	160	320	160	80	160	320	80	5	10/18/08	X1/C1
34	A/THAILAND/944/2008	20	10	160	80	160	40	20	40	160	20	10	11/06/08	C2/C1
35	A/THAILAND/998/2008	20	80	160	160	320	80	80	80	160	40	10	11/03/08	C2/C1

* Serology antigen

Influenza A(H3N2) Isolates Characterized by CDC

	U.S.A.	North America	Europe	Asia	Cent/So America	Africa, Australia, New Zealand	Total (%)
April 2007 – September 2007							
A/Wisconsin/67/2005-like*	24		6	4	16	1	51 (8%)
A/Wisconsin/67/2005-like**	6		5	2	5		18 (3%)
A/Wisconsin/67/2005 (low)***	27	4	8	20	113	2	174 (26%)
A/Brisbane/10/2007-like	19	18	5	108	227	30	407 (63%)
						Total	650
October 2007 – March 2008							
A/Wisconsin/67/2005-like	99					1	100 (15%)
A/Brisbane/10/2007-like*	301	20	5	65	10	4	405 (59%)
A/Brisbane/10/2007-like**	94	8	3	32	3		140 (20%)
A/Brisbane/10/2007 (low)***	30	2	2	9		1	44 (6%)
						Total	689
April 2008 – September 2008							
A/Wisconsin/67/2005-like	1						1 (1%)
A/Brisbane/10/2007-like*	16	2	3	26	4	32	83 (51%)
A/Brisbane/10/2007-like**	8		3	29	8	13	61 (38%)
A/Brisbane/10/2007 (low)***	1		3	5	1	6	16 (10%)
						Total	161
October 2008 – December 2008							
A/Wisconsin/67/2005-like							
A/Brisbane/10/2007-like*	23			6			29(58%)
A/Brisbane/10/2007-like**	9		1	6			16(32%)
A/Brisbane/10/2007 (low)***	3			2			5(10%)
						Total	50
Total	661	54	44	314	387	90	1550

* ≤ 2-fold low to vaccine strain
** = 4-fold low to vaccine strain
*** ≥ 8-fold low to vaccine strain

Preliminary Data 01/28/2009

Microneutralization Reactions of Influenza A (H3N2) Viruses (Feb. 2009)

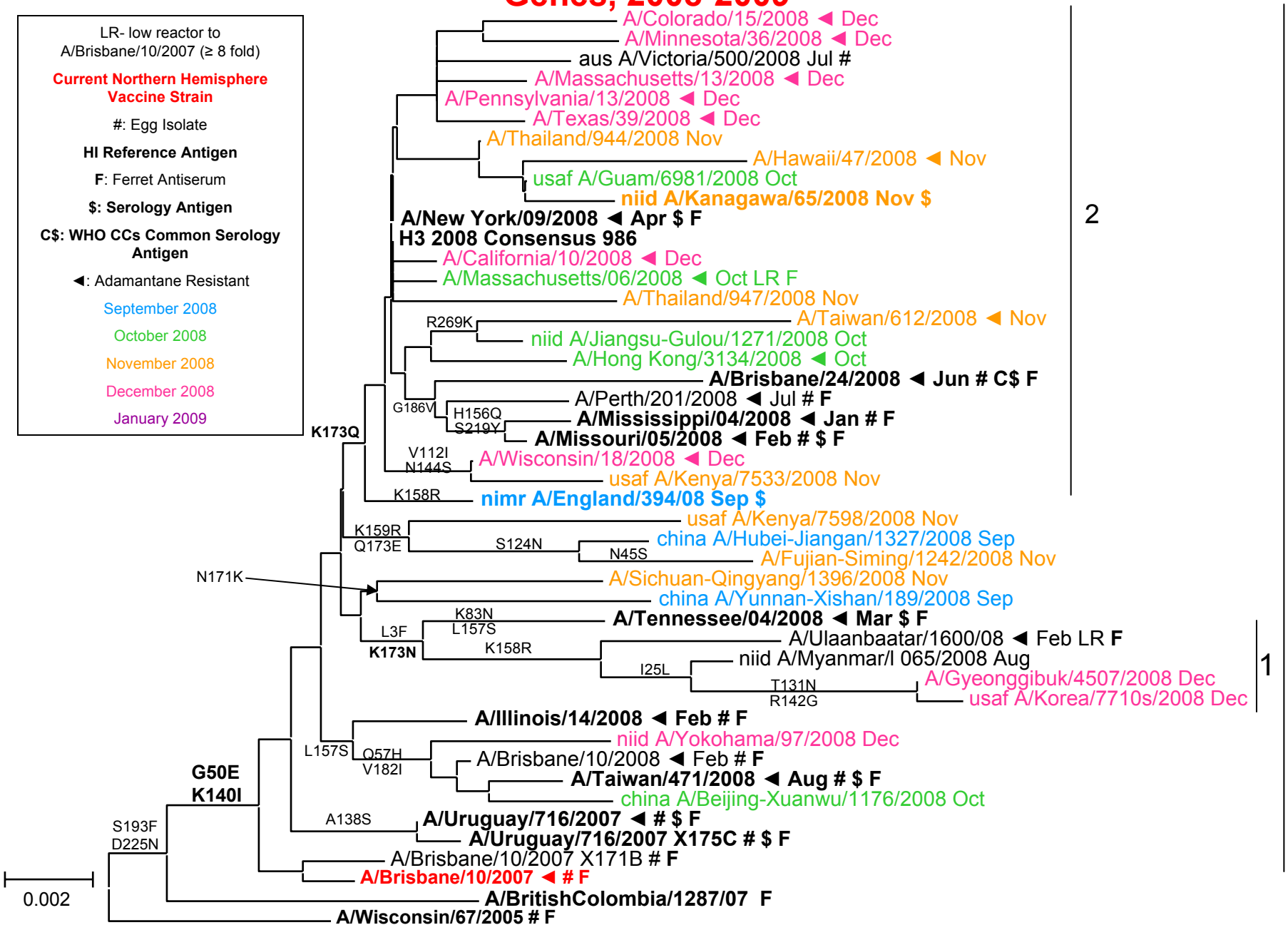
		Ferret Antisera							
				Bris/10		Clade 2		BC	
	Strain Designation	WY/03	WI/67	UY/E	UY/M	NY/9	AS/201	CN/1287	Passage
1	A/WYOMING/3/2003	200	100	100	25	50	25	25	Spfck2/E4
2	A/WISCONSIN/67/2005	25	800	400	50	400	200	25	Spfck3/E5
3	A/URUGUAY/716/2007 E	50	800	1600	800	1600	50	50	Spfck1/E4
4	A/URUGUAY/716/2007 M	25	400	800	200	800	200	50	C1/C4
5	A/NEW YORK/9/2008	50	200	400	100	400	100	50	M1/C3
7	A/PERTH/201/2008	25	1600	1600	400	3200	800	400	E4/E3
6	A/BRITISH COLUMBIA/RV1287/2007	25	50	200	25	200	200	400	C1/C6
8	A/MISSOURI/5/2008	50	1600	800	200	800	400	100	E6
9	A/BRISBANE/24/2008	50	1600	1600	1600	3200	400	200	E5/E2
10	A/TENNESSEE/4/2008	50	400	800	400	800	200	100	MX/C3

Plaque Reduction Neutralization for H3N2 Viruses (Jan. 2009)

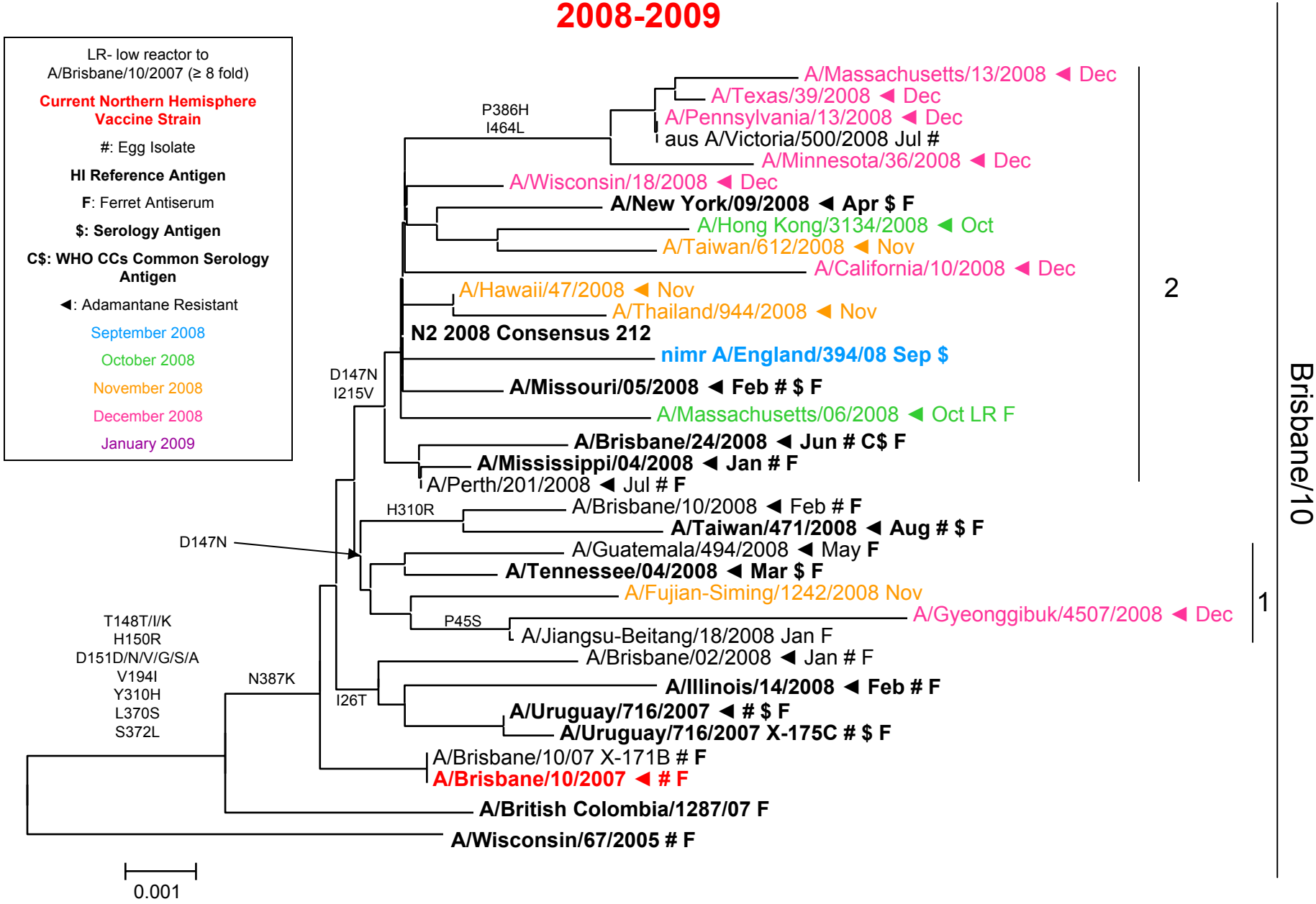
		FERRET ANTISERA							POOLED HUMAN SERA*				
				Bris/10		Clade 2		BC	Adults			PED	PASSAGE
	STRAIN DESIGNATION	WY/3	WI/67	UY/E	UY/ M	NY/9	AS/201	CN/1287	EU	U.S.	JP	U.S.	
1	A/WYOMING/3/03	2560	640	640	1280	320	160	80	640	320	640	320	Spfck2/E4
2	A/WISCONSIN/67/05	160	>5120	1280	1280	1280	640	160	QNS	QNS	QNS	QNS	Spfck3/E5
3	A/URUGUAY/716/07 E	320	5120	5120	5120	5120	1280	640	1280	640	1280	640	Spfck1/E4
4	A/URUGUAY/716/07 M	160	2560	2560	5120	1280	640	80	QNS	QNS	QNS	QNS	C1/C4
5	A/NEW YORK/9/08	160	640	1280	1280	1280	640	640	640	QNS	640	640	M1/C3
6	A/PERTH/201/08	160	5120	1280	1280	1280	5120	640	QNS	QNS	QNS	QNS	E4/E3
7	A/BRITISH COLUMBIA/RV1287/07	80	640	1280	1280	1280	640	5120	640	640	640	640	C1/C6
8	A/ENGLANG/394/2008	160	640	640	640	1280	1280	5120	QNS	QNS	QNS	QNS	XS6/S1
9	A/BRISBANE/24/08	640	5120	1280	1280	2560	640	160	1280	QNS	1280	1280	E5/E2
10	A/MISSOURI/5/2008	160	1280	640	640	640	1280	320	QNS	QNS	QNS	QNS	E6
11	A/TENNESSEE/4/2008	320	5120	5120	5120	5120	2560	2560	QNS	QNS	QNS	QNS	MX/C3

* Vaccinees received 2008-2009 trivalent influenza vaccine. A/Uruguay/716/2007, an A/Brisbane/10/2007-like virus, was the H3 component of the vaccine.

Evolutionary Relationships Among Influenza A (H3N2) Hemagglutinin (HA1) Genes, 2008-2009



Evolutionary Relationships Among Influenza A (H3N2) Neuraminidase Genes, 2008-2009



Influenza B Viruses

HEMAGGLUTINATION INHIBITION REACTIONS OF INFLUENZA TYPE B VIRUSES (02/04/09)

		1	3						Date	
REFERENCE ANTIGENS		FL/4	BA/3333	OH/1	MY/2506	HK/90	CH/1272	AS/33	collected	Passage
1	B/FLORIDA/04/2006*	640	640	20	20	5	160	10	11/01/06	E3
2	B/BANGLADESH/3333/2007	320	640	10	20	5	80	10	08/19/07	E4
3	B/OHIO/01/2005	5	5	1280	2560	160	5120	320	02/23/05	E3
4	B/MALAYSIA/2506/2004	5	5	1280	5120	160	5120	320	06/12/04	E3/E2
5	B/HONG KONG/90/2008	5	5	640	2560	320	2560	1280	02/04/08	E2
6	B/FUJIAN/GULOU/1272/2008*	5	5	640	1280	80	2560	160	03/13/08	E1/E2
7	B/BRISBANE/33/2008	5	5	640	1280	160	1280	640	07/13/08	E3
TEST ANTIGENS										
8	B/TEXAS/40/2008	1280	1280	80	40	5	160	10	10/18/08	M1/C1
9	B/KENTUCKY/01/2008	320	320	10	40	5	160	5	12/31/08	M1/C2
10	B/TEXAS/36/2008	160	640	10	5	5	80	10	12/18/08	M1/C1
11	B/MARYLAND/04/2008	160	640	5	5	5	80	10	12/15/08	M1/C1
12	B/NEW HAMPSHIRE/02/2008	80	320	20	5	5	80	10	12/10/08	M1/C1
13	B/BRAZIL/7800/2008	160	640	5	5	5	80	10	09/10/08	E3
14	B/HONDURAS/207/2008	80	320	5	5	5	40	10	10/20/08	X/C1
15	B/HONDURAS/216/2008	80	320	5	5	5	40	5	10/27/08	X/C1
16	B/HONG KONG/1378/2008	640	1280	5	5	5	80	20	11/06/08	C2/C1
17	B/HONG KONG/1377/2008	320	640	5	5	5	80	20	10/23/08	C2/C1
18	B/THAILAND/1024/2008	160	320	5	5	5	80	10	12/01/08	C1/C1
19	B/INDIA/7314/2008	160	320	5	5	5	40	5	12/04/08	X1/C1
20	B/TOCHIGI/15/2008	80	320	5	5	5	40	10	11/07/08	C1/C1
21	B/ALASKA/07/2008	5	5	640	1280	160	2560	320	12/15/08	M1/C1
22	B/NEW JERSEY/01/2009	5	5	640	1280	320	2560	640	01/16/09	MX/C1
23	B/TEXAS/23/2008	5	5	320	1280	160	1280	640	10/22/08	E2
24	B/PENNSYLVANIA/03/2008	5	5	80	640	80	320	160	12/15/08	E3
25	B/FLORIDA/29/2008	5	5	160	160	320	1280	640	12/16/08	MX/C1
26	B/MARYLAND/05/2008	5	5	160	160	320	640	320	12/24/08	M1/C1
27	B/FLORIDA/31/2008	5	5	80	80	320	1280	320	12/24/08	MX/C1
28	B/INDIANA/14/2008	5	5	160	80	640	640	160	01/14/09	M1/C1
29	B/TEXAS/41/2008	5	5	160	80	320	640	320	12/30/08	M1/C1
30	B/BRISBANE/60/2008*	5	5	640	640	160	1280	640	08/04/08	E4/E4
31	B/BAYERN/36/2008	5	5	80	80	160	640	320	10/23/08	C2/S2
32	B/INDIA/9884/2008	5	5	1280	2560	640	5120	1280	10/27/08	X1/C1
33	B/TOCHIGI/15/2008	5	5	1280	2560	160	5120	320	11/20/08	C3/C1
34	B/BANGLADESH/3266/2008	5	5	640	1280	80	2560	160	06/20/08	E2
35	B/HONG KONG/1384/2008	5	5	80	80	5	640	40	12/01/08	C2/C1
36	B/INDIA/7290/2008	5	5	80	80	80	640	80	11/05/08	X1/C1

*Serology antigen

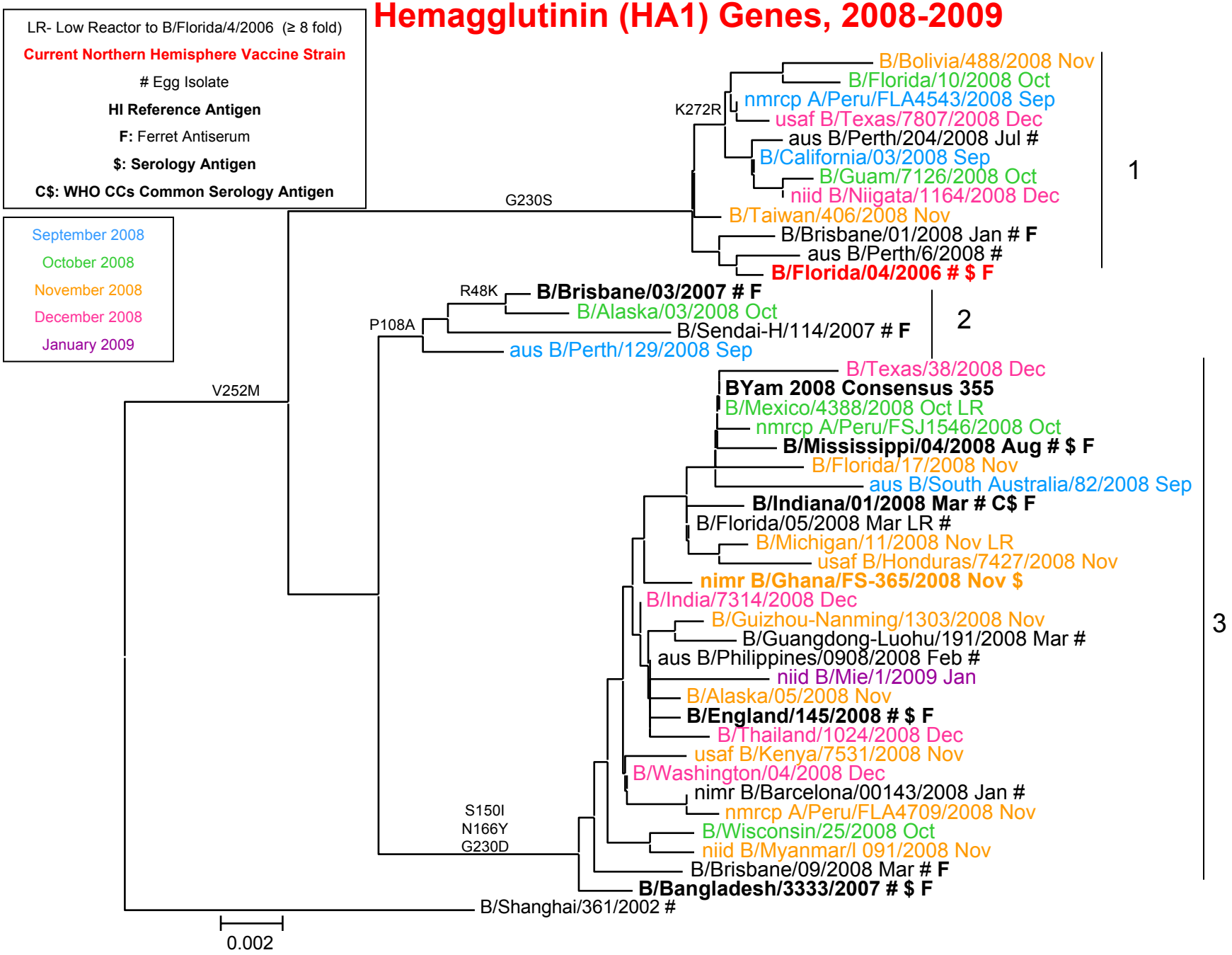
Influenza B Isolates Characterized by CDC

	U.S.A.	North America	Europe	Asia	Cent/So America	Africa, Australia, New Zealand	Total (%)
April 2007 – September 2007							
B/Ohio/01/2005-like*	1		3	18	10	7	39 (16%)
B/Ohio/01/2005-like**	1		1	10		3	15 (6%)
B/Ohio/01/2005 (low)***	7	1	3	16	7	6	40 (17%)
B/Florida/04/2006-like	18	3	2	84	31	3	141 (59%)
B/Florida/04/2006 (low)				6			6 (2%)
						Total	241
October 2007 – March 2008							
B/Ohio/01/2005-like	6			61	1	9	77 (9%)
B/Ohio/01/2005 (low)	3		2	44	2	1	52 (7%)
B/Florida/04/2006-like*	340	5	43	173	16	5	582 (70%)
B/Florida/04/2006-like**	88	2	4	14	1		109 (13%)
B/Florida/04/2006 (low)***	8		1	2			11 (1%)
						Total	831
April 2008 – September 2008							
B/Ohio/01/2005-like			1	10	40	5	56 (12%)
B/Ohio/01/2005 (low)	2		1	59	5	10	77 (17%)
B/Florida/04/2006-like*	36	4	9	31	98	15	193 (42%)
B/Florida/04/2006-like**	26	3	3	14	24	37	107 (24%)
B/Florida/04/2006 (low)***	1	3	1	1	2	16	24 (5%)
						Total	457
October 2008 – January 2009							
B/Ohio/01/2005-like	11			5			16 (14%)
B/Ohio/01/2005 (low)	45		1	8	1		55 (46%)
B/Florida/04/2006-like*	12			5	3		20 (17%)
B/Florida/04/2006-like**	12			5			17 (14%)
B/Florida/04/2006 (low)***	4	1		3	3		11 (9%)
						Total	119
Total	621	22	75	569	244	117	1648

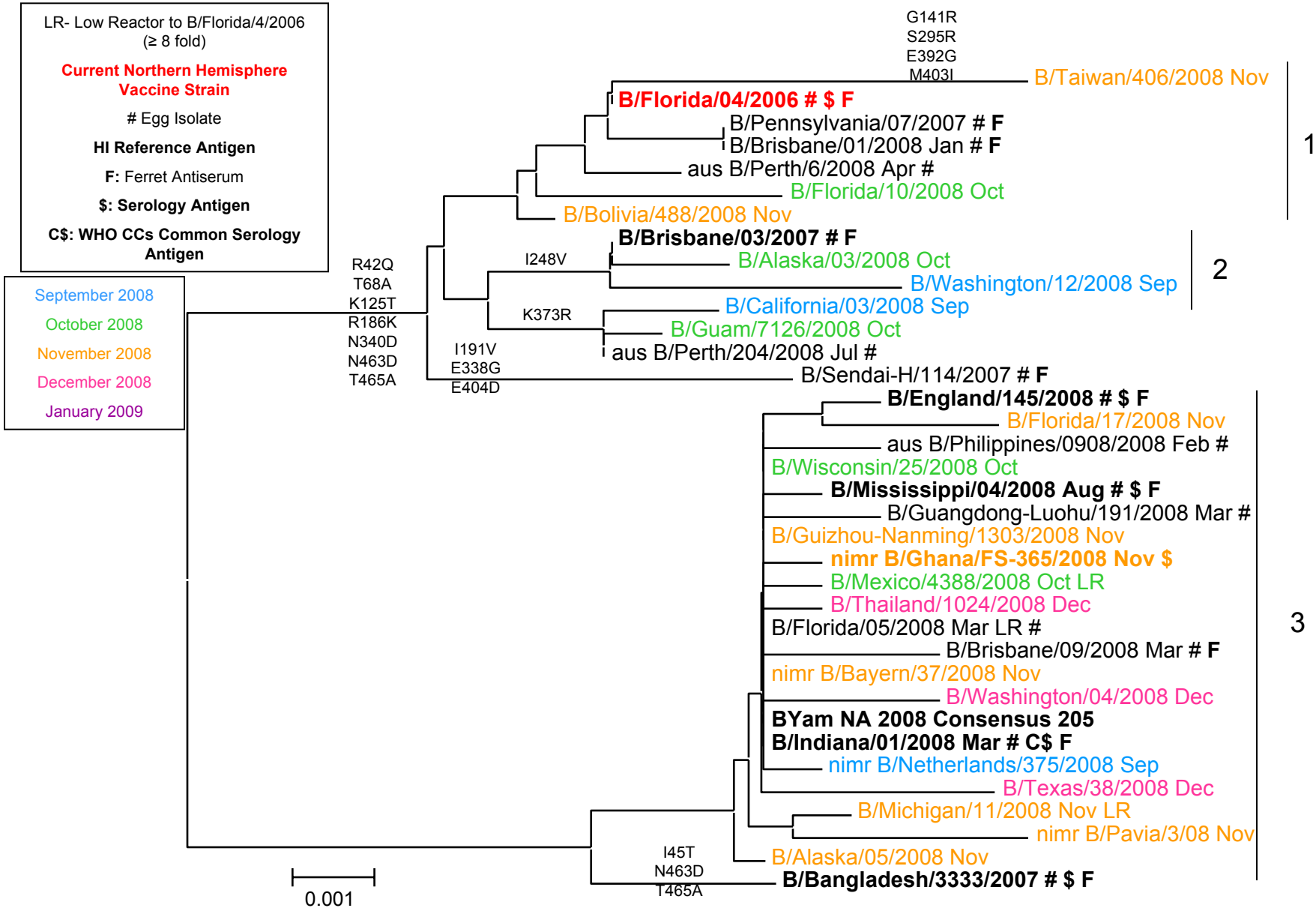
* ≤ 2-fold low to vaccine strain
** = 4-fold low to vaccine strain
*** ≥ 8-fold low to vaccine strain

Preliminary Data 02/04/2009

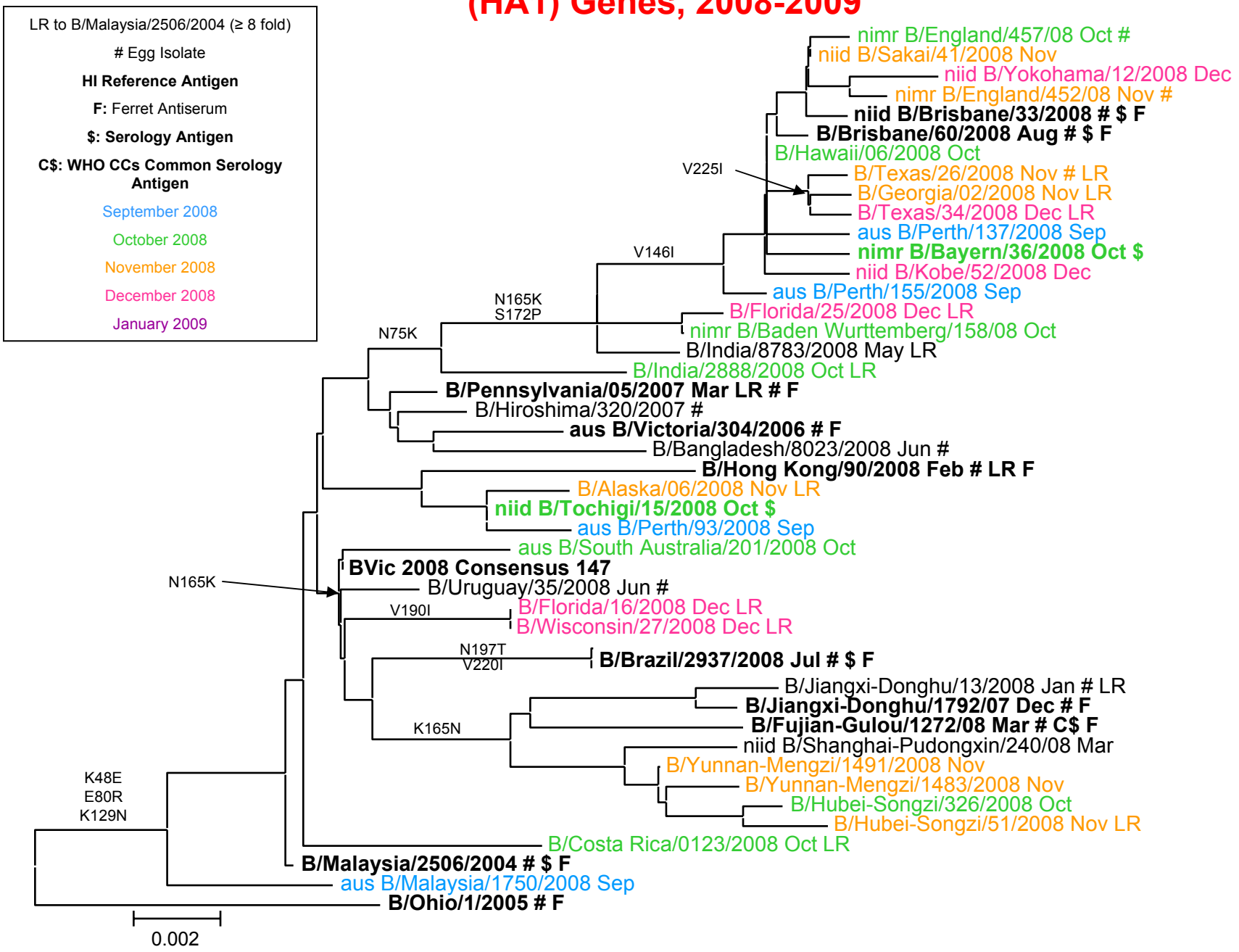
Evolutionary Relationships Among Influenza B Yamagata Lineage Hemagglutinin (HA1) Genes, 2008-2009



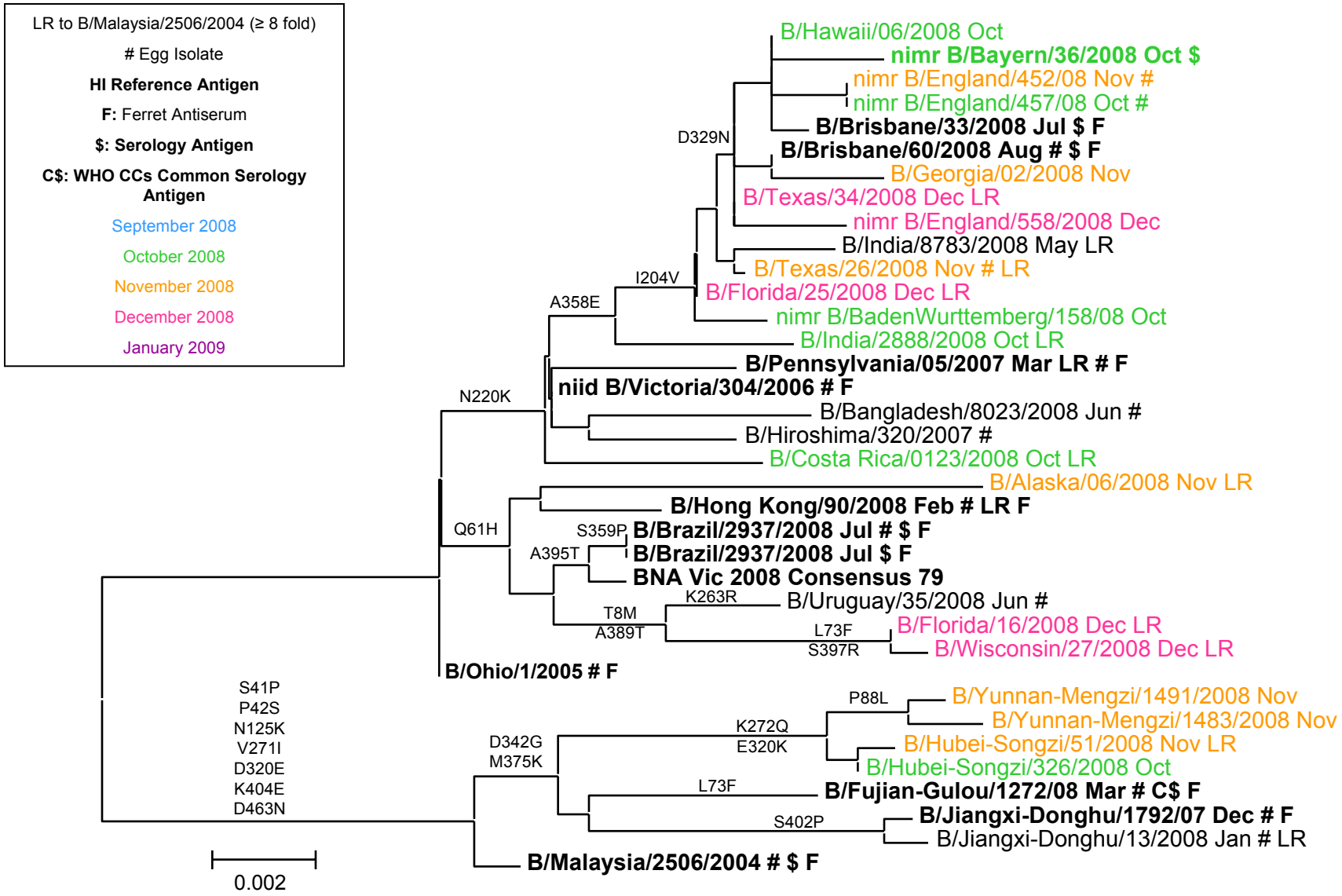
Evolutionary Relationships Among Influenza B Yamagata Lineage Neuraminidase (NA) Genes, 2008-2009



Evolutionary Relationships Among Influenza B Victoria Lineage Hemagglutinin (HA1) Genes, 2008-2009



Evolutionary Relationships Among Influenza B Victoria Lineage Neuraminidase (NA) Genes, 2008-2009



Drug Resistance

Update on frequency of neuraminidase inhibitor resistance: week of 02-04-2009

Virus collection period: Oct 01, 2008 – Jan 20, 2009

	Isolates tested (n)	Resistant (%)	
		Zanamivir	Oseltamivir
US isolates:	308	0 (0)	185 (60.1%)
A/H1N1	190	0 (0)	185 (97.4%)
A/H3N2	41	0 (0)	0 (0)
Influenza A (H1N1+H3N2)	231	0 (0)	185 (80.1%)
Influenza B	77	0 (0)	0 (0)
Foreign isolates:	119	0 (0)	37 (31.1%)
A/H1N1	67	0 (0)	37 (55.2%)
A/H3N2	18	0 (0)	0 (0)
Influenza A (H1N1+H3N2)	85	0 (0)	37 (43.5%)
Influenza B	34	0 (0)	0 (0)
Global isolates:	427	0 (0)	222 (52.0%)
A/H1N1	257	0 (0)	222 (86.4%)
A/H3N2	59	0 (0)	0 (0)
Influenza A (H1N1+H3N2)	316	0 (0)	222 (70.3%)
Influenza B	111	0 (0)	0 (0)

Update on frequency of adamantane resistance: week of 02-04-2009

Virus collection period: Oct 01, 2008 – Jan 20, 2009

	Isolates tested (n)	Resistant isolates	% Resistance
Type A, US Isolates:	231	43	18.6
A/H1N1	190	2	1.1
A/H3N2	41	41	100
Type A, Foreign Isolates:	85	45	52.9
A/H1N1	67	27	40.3
A/H3N2	18	18	100
Type A, Global Isolates:	316	88	27.8
A/H1N1	257	29	11.3
A/H3N2	59	59	100