OFFLU swine influenza virus meeting
27 – 28 March 2017
FAO Headquarters, Rome, Italy

Swine Influenza Virus Surveillance – Canada

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Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Acknowledgements

Dr. Davor Ojkic, AHL, Guelph

Dr. Neil Pople, MAFRD, Winnipeg

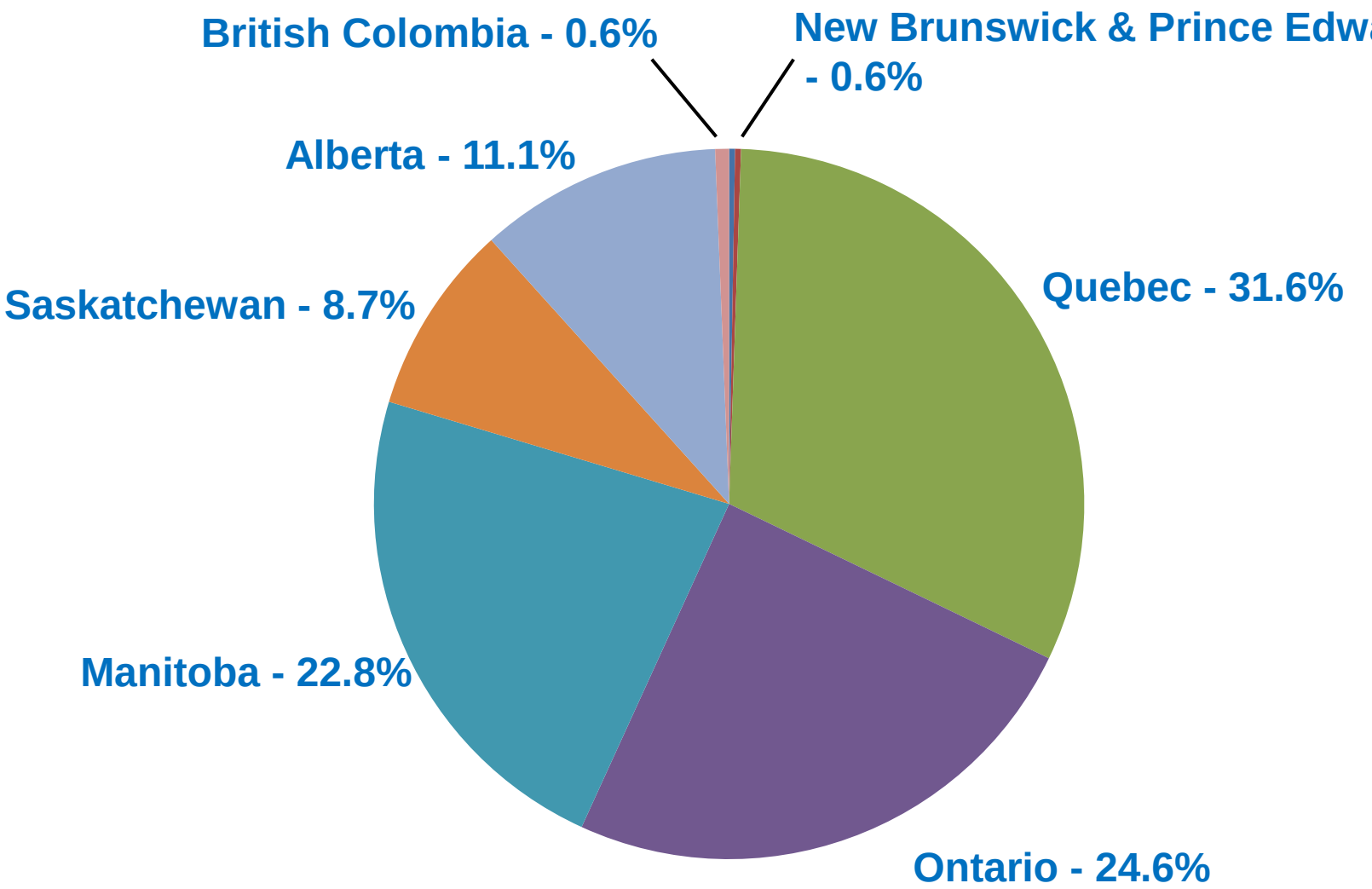
Dr. Julie-Hélène Fairbrother, LEAQ, St-Hyacinthe

Dr. Andre Broes, Bio-Vet, St-Hyacinthe

Dr. Wanhong Xu, NCFAD, Winnipeg
Dr. Brad Pickering, NCFAD, Winnipeg
Matt Suderman, NCFAD, Winnipeg
Tamiko Hisanaga, NCFAD, Winnipeg

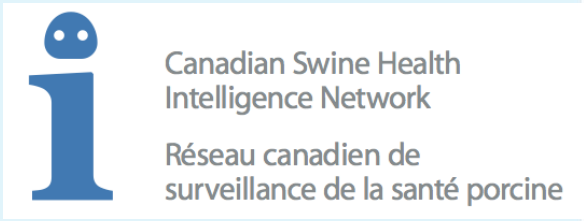

Yukon
Whitehorse
Great Bear Lake
Northwest Territories
Yellowknife
Great Slave Lake
Nunavut
Iqaluit
Lake Athabasca
British Columbia
Alberta
Edmonton
Victoria
Saskatchewan
Regina
Manitoba
Lake Winnipeg
Winnipeg
Ontario
Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Toronto
Lake Ontario
Ottawa
Quebec
Quebec
Newfoundland and Labrador
St. John's
Charlottetown
Prince Edward Island
Fredericton
New Brunswick
Halifax
Nova Scotia

Canadian Pig Inventory 2016



13.7 million

Canadian Swine Health Intelligence Network



- In 2016 there were a total of 54 veterinarians that participated in the network
  - 20 from Quebec
  - 10 from Ontario
  - 24 from Western Canada
- Practitioners in all regions reported increases in swine influenza cases in the 3rd and 4th quarters of 2016
- Majority of samples from Western Canada were H1N2

Characterisation of Viruses Identified Through Passive Surveillance

- Collaboration between NCFAD, Winnipeg and Quebec, Ontario and Manitoba
- Laboratoire d'Epidemiosurveillance Animale du Quebec (LEAQ) and Bio-Vet – St-Hyacinthe, Quebec
- Animal Health Laboratory (AHL) – Guelph, Ontario
- Manitoba Agriculture, Food and Rural Development (MAFRD), Veterinary Diagnostic Services – Winnipeg, Manitoba

Swine Influenza Viruses in Canada, 2013-2016

- H1N1pdm09 isolated from swine across Canada
- A clear divide exists between other H1 lineage viruses circulating in Eastern versus Western Canada
- Eastern Canada (Quebec and Ontario) predominantly classical swine lineage H1N1 – clade 1A.2 (β-H1)
- Western Canada (Manitoba, Saskatchewan and Alberta) predominantly classical swine lineage H1N2 – clade 1A.1 (α-H1)
- A divide also appears to exist between Eastern and Western Canada for H3N2 viruses circulating in pigs

Vaccination

Dr. Susan Detmer, Department of Veterinary Pathology, University of Saskatchewan described three outcomes

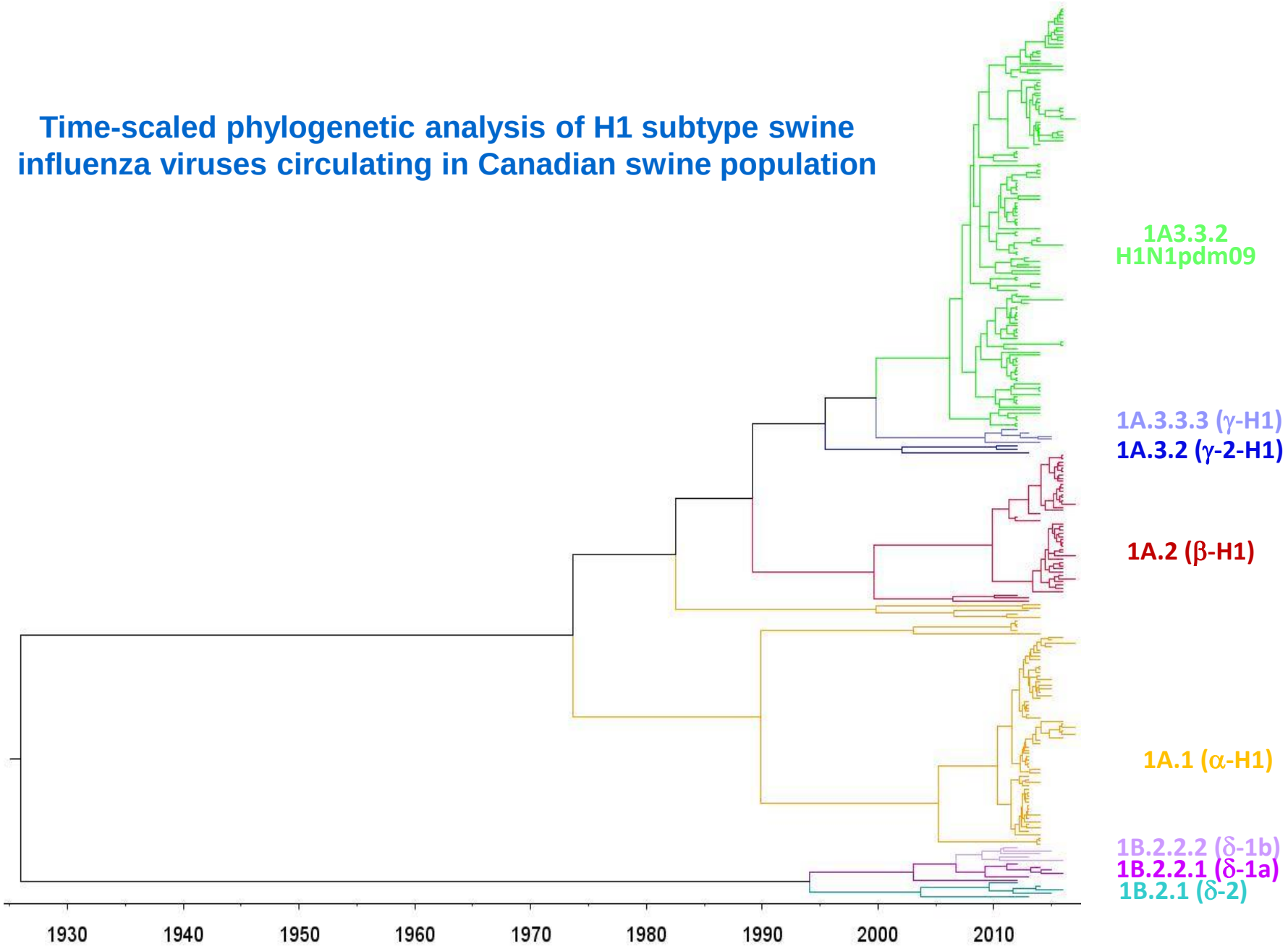
1. The virus is removed from the barn
2. A second virus already present or a newly introduced one becomes dominant
3. The virus evolves involving 2 or 3 amino acid changes in the major antigenic regions of the HA and the vaccine no longer works

More autogenous vaccines are being developed for all regions of the country to deal with viruses not controlled by commercial vaccines

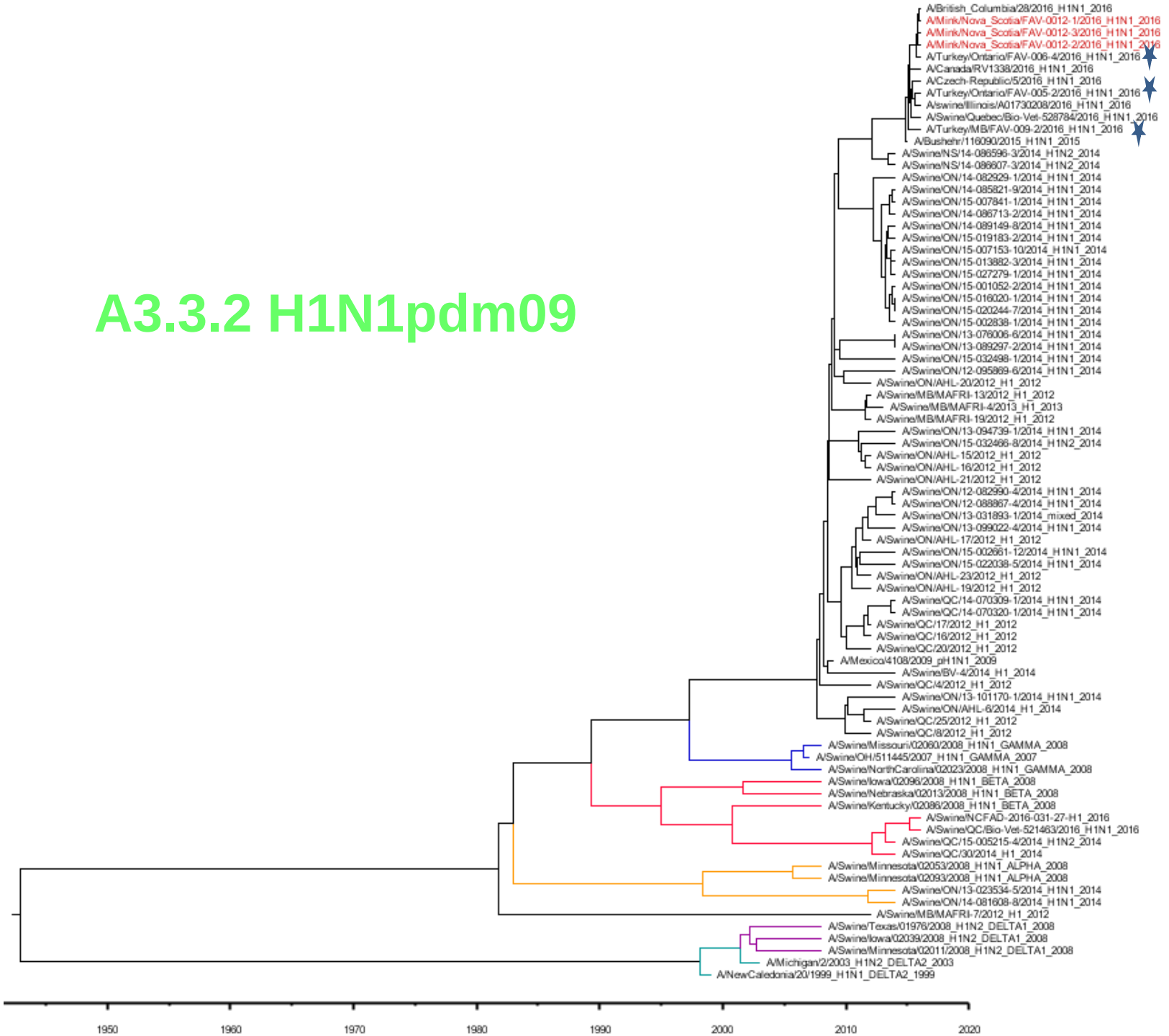
Swine H1N1/N2 Isolates Characterized at NCFAD

	H1N1/N2			
Province	H1N1/N2	pH1	1A.2 (β)	1A.1 (α)
Ontario	96	58	30	8
Quebec	30	15	13	2
Manitoba	13	9	-	4
Total	139	82	43	14

Time-scaled phylogenetic analysis of H1 subtype swine influenza viruses circulating in Canadian swine population



A3.3.2 H1N1pdm09



pH1

H1-γ

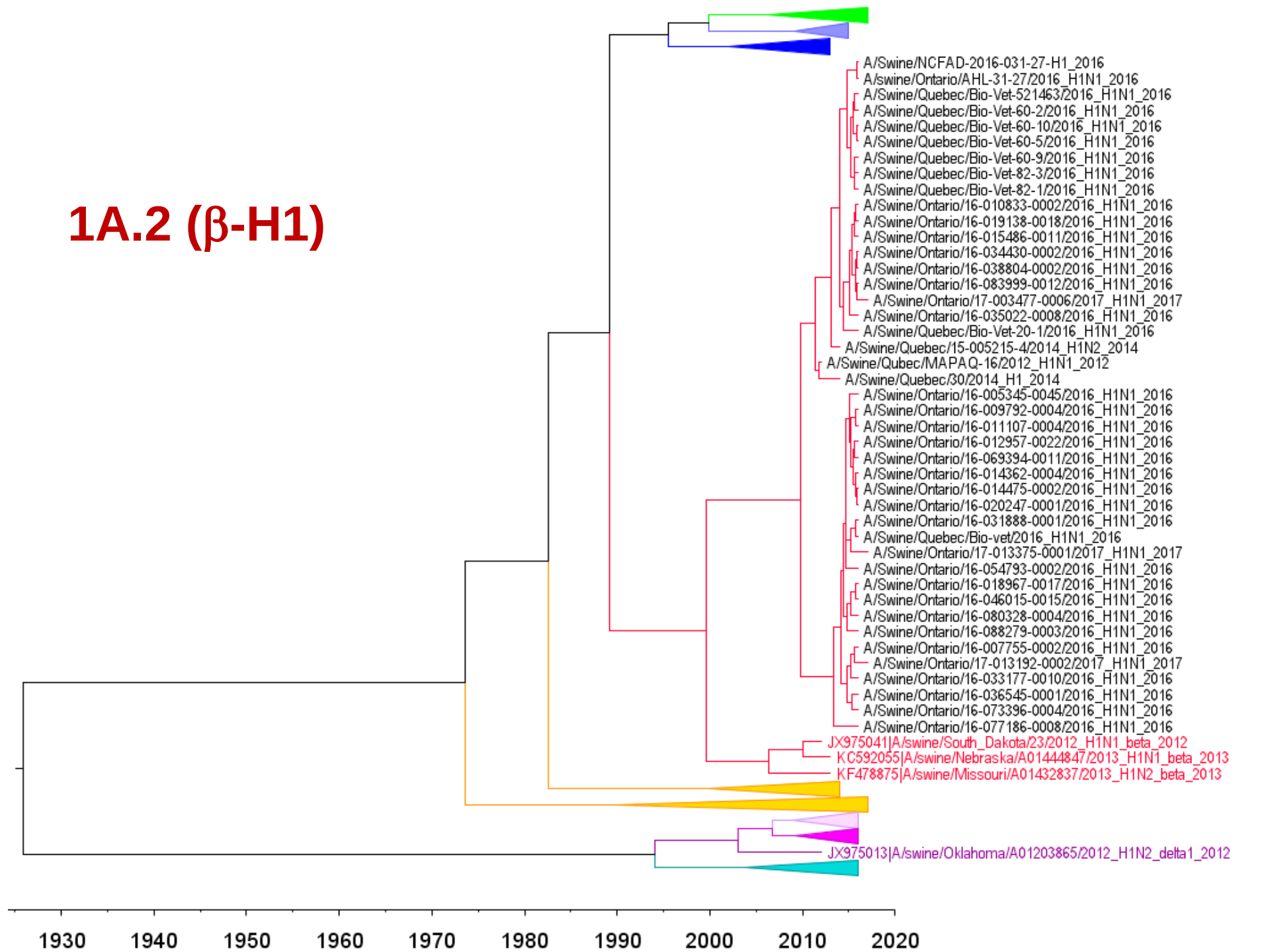
H1-β

H1-α

H1-δ1

H1-δ2

1A.2 (β-H1)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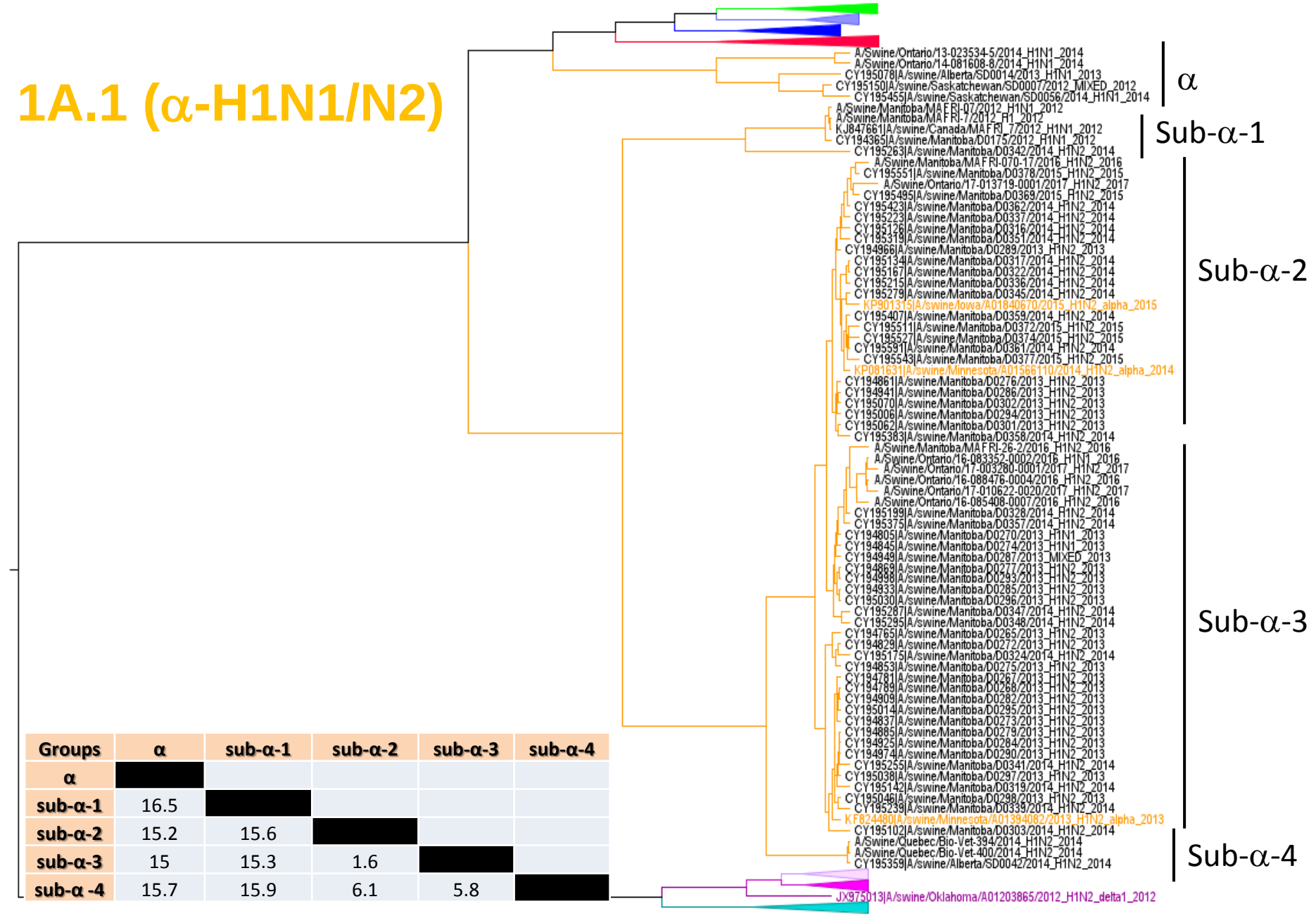
2020

1A.1 (α-H1N1/N2)

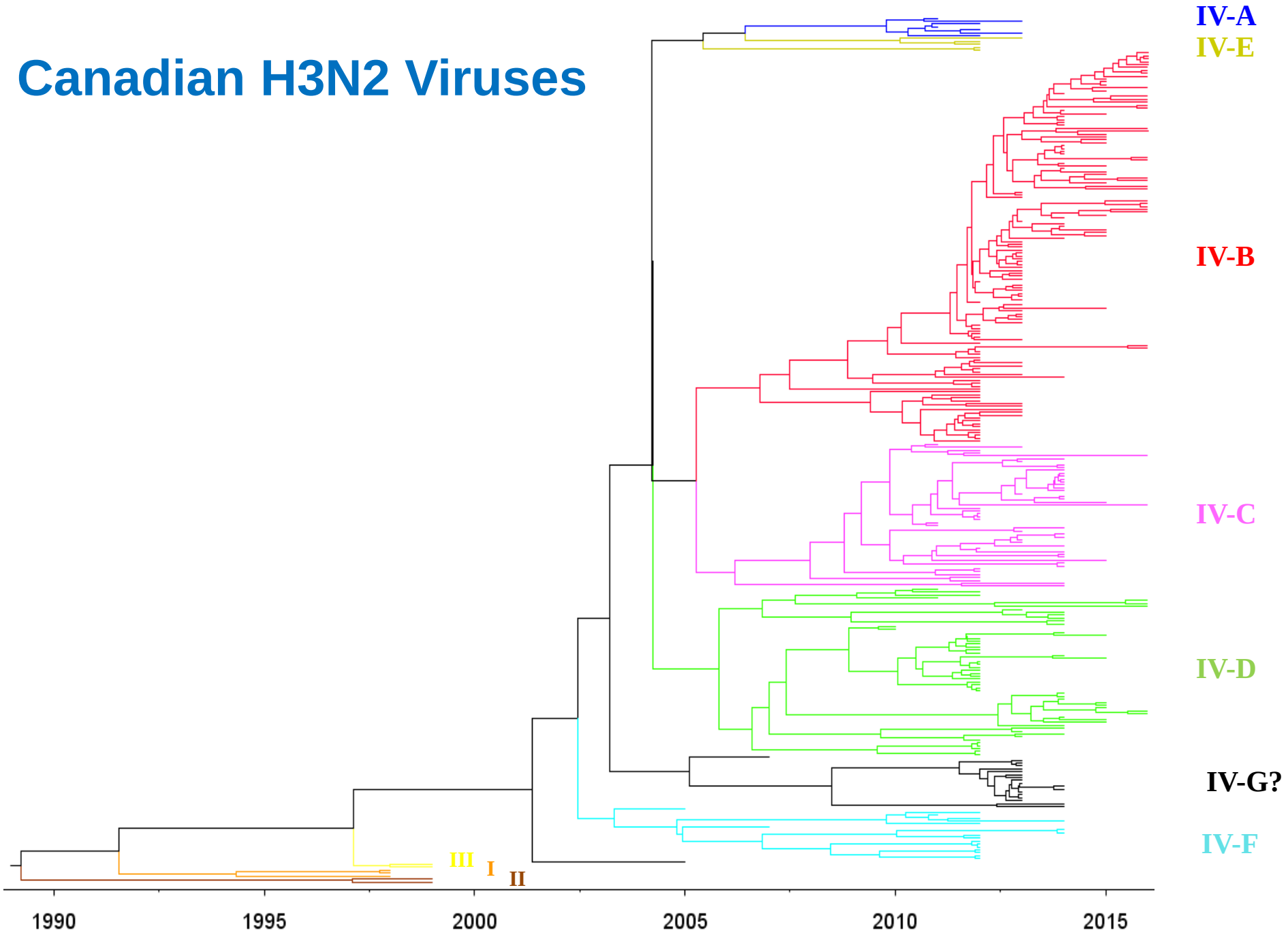


Groups	α	sub-α-1	sub-α-2	sub-α-3	sub-α-4
α					
sub-α-1	16.5				
sub-α-2	15.2	15.6			
sub-α-3	15	15.3	1.6		
sub-α -4	15.7	15.9	6.1	5.8	

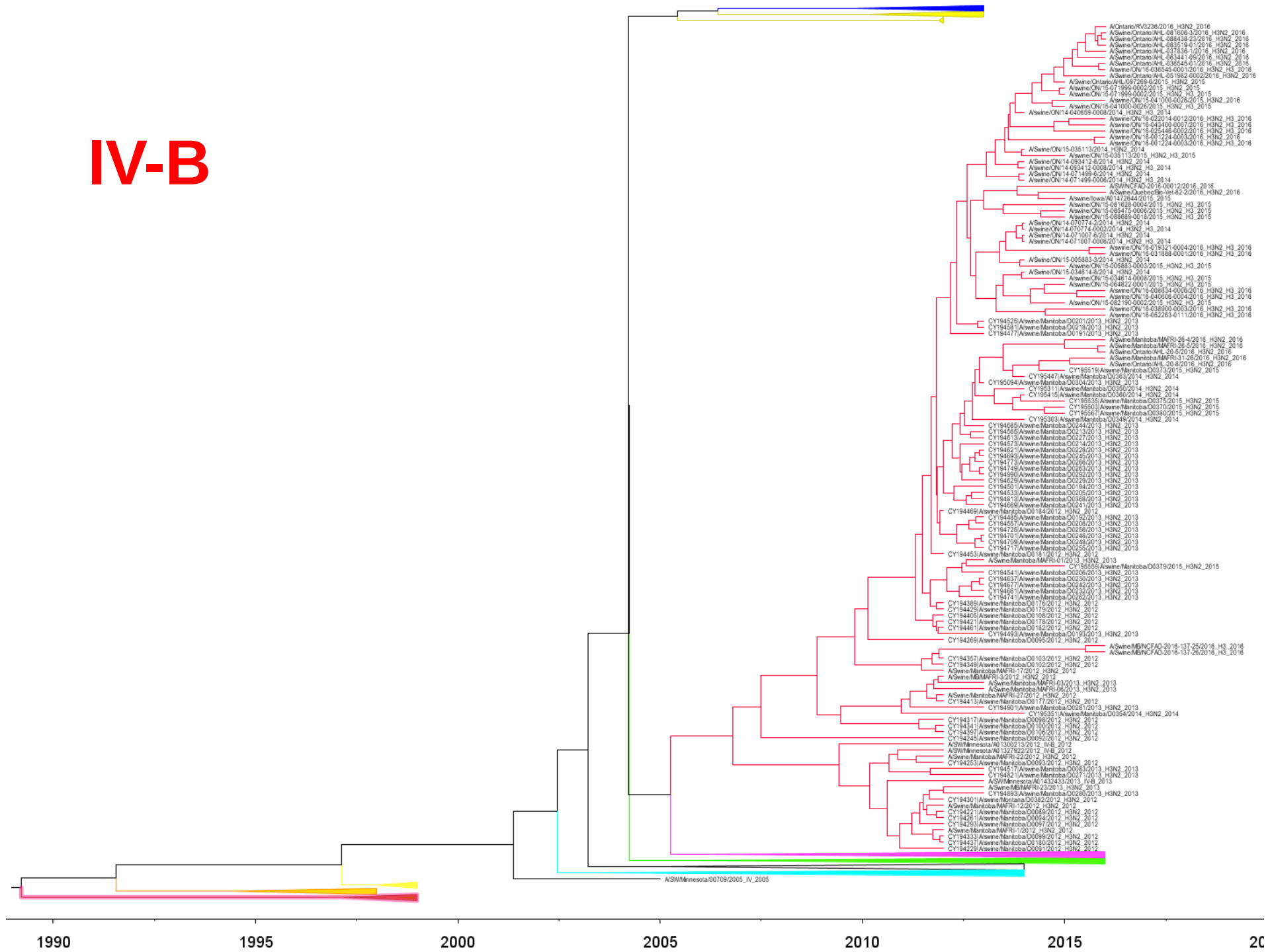
Swine H3N2 Isolates Characterized at NCFAD

	H3N2							
Province	H3N2	IV-A	IV-B	IV-C	IV-D	IV-E	IV-F	IV-G?
Ontario	120	-	46	32	38	-	4	-
Quebec	22	-	2	8	5	-	7	-
Manitoba	27	-	20	0	3	2	0	2
Total	167	-	68	40	46	2	11	2

Canadian H3N2 Viruses



IV-B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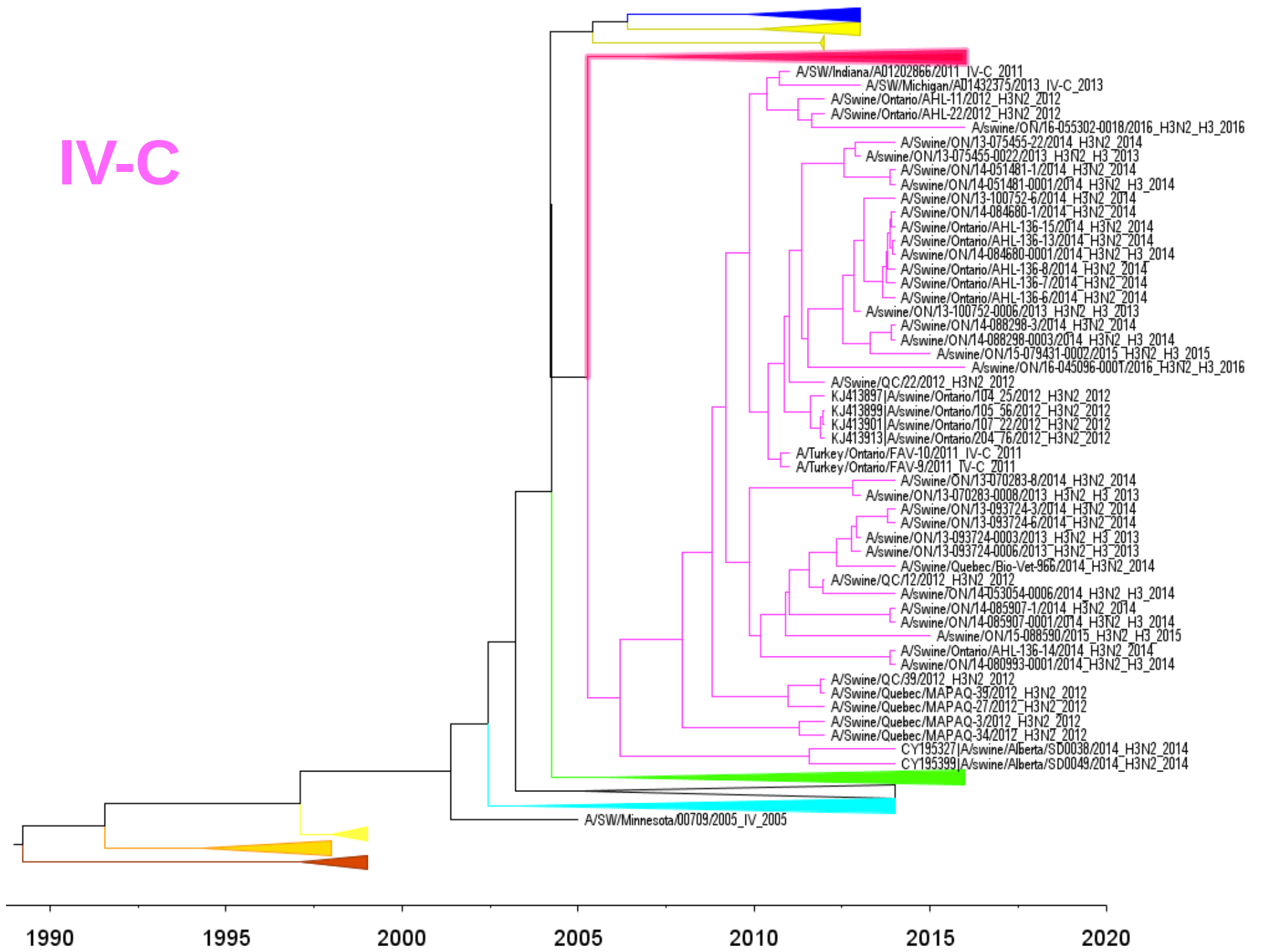
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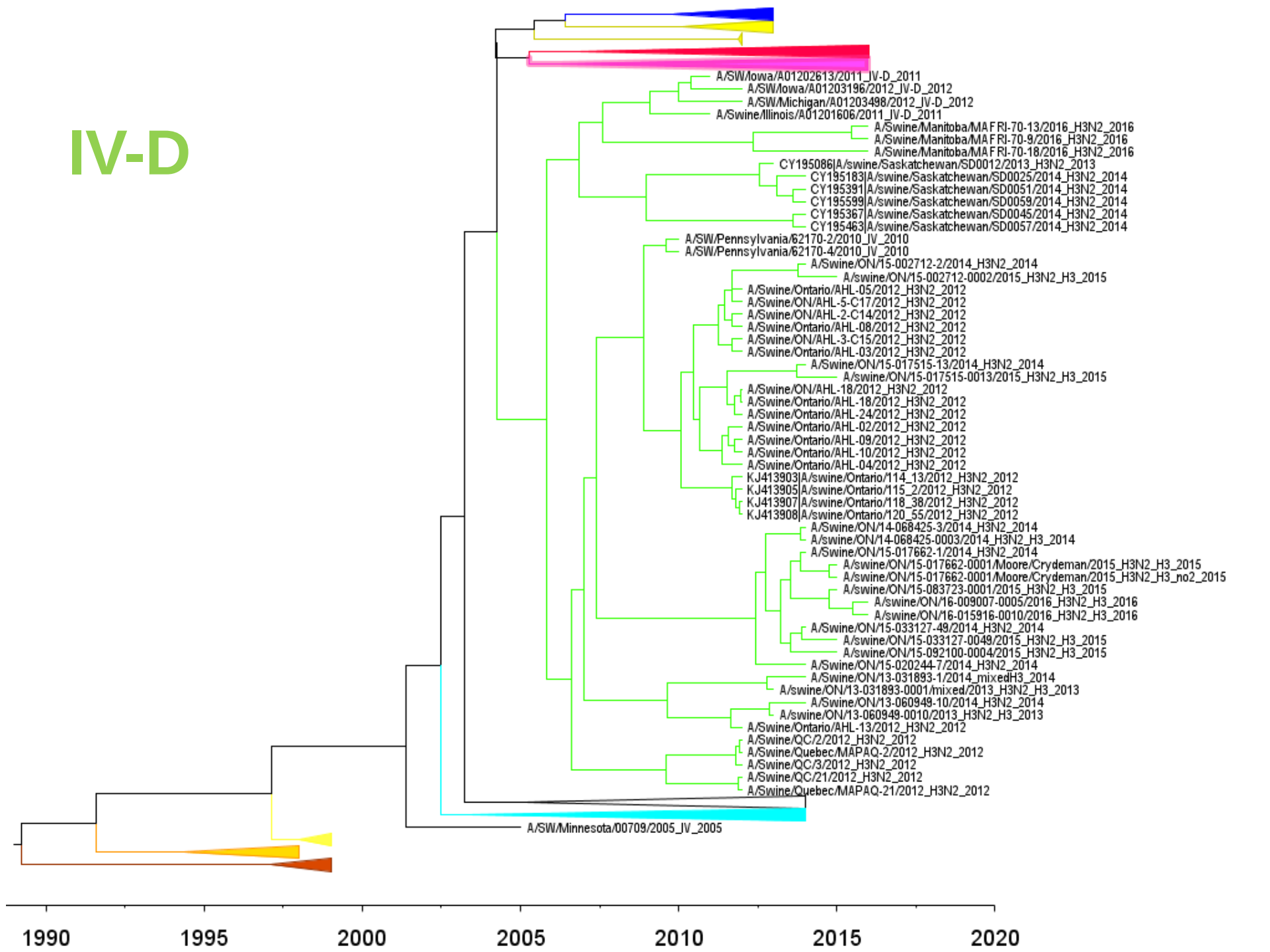
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A/SW/Minnesota/00709/2005_IV_2005
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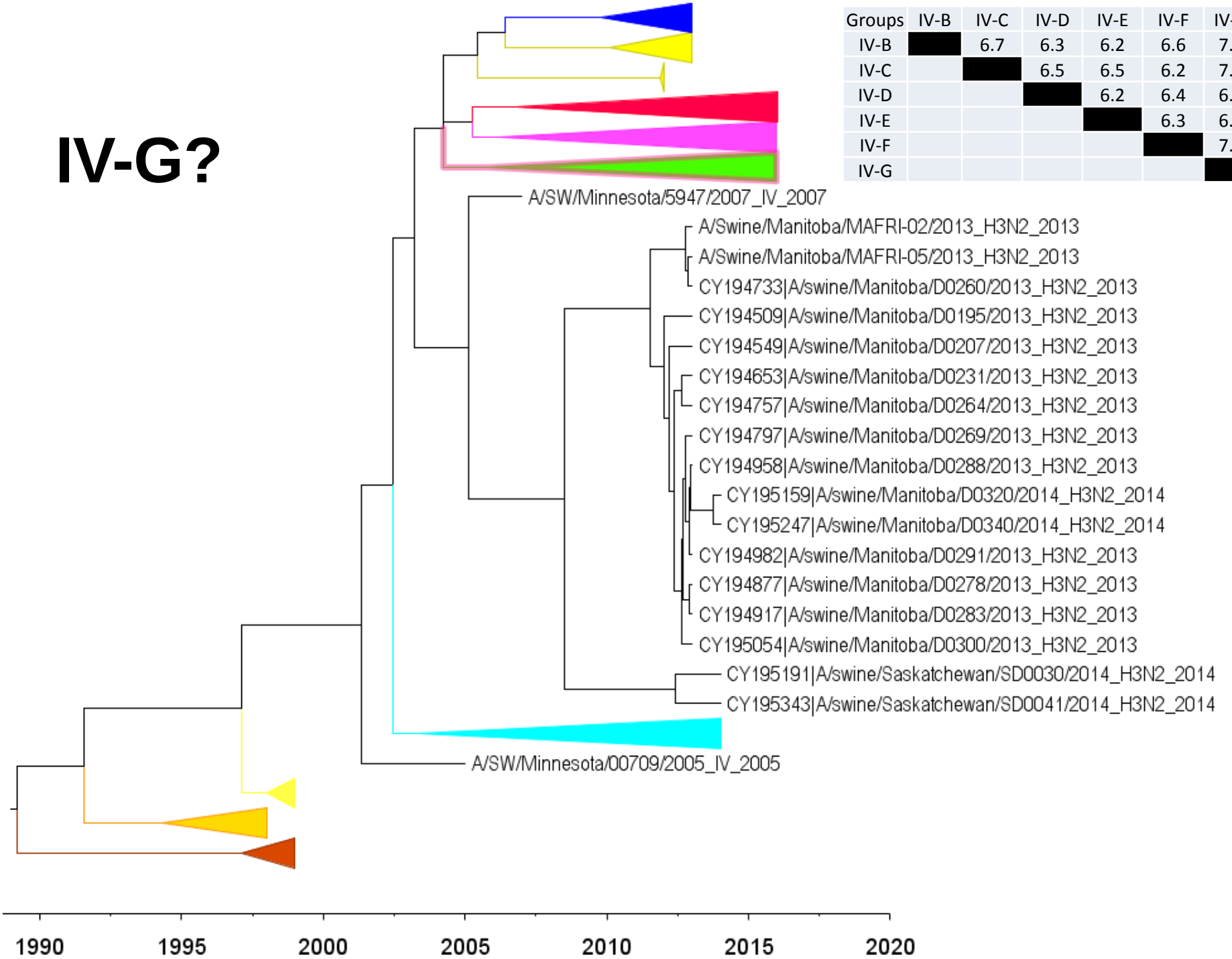
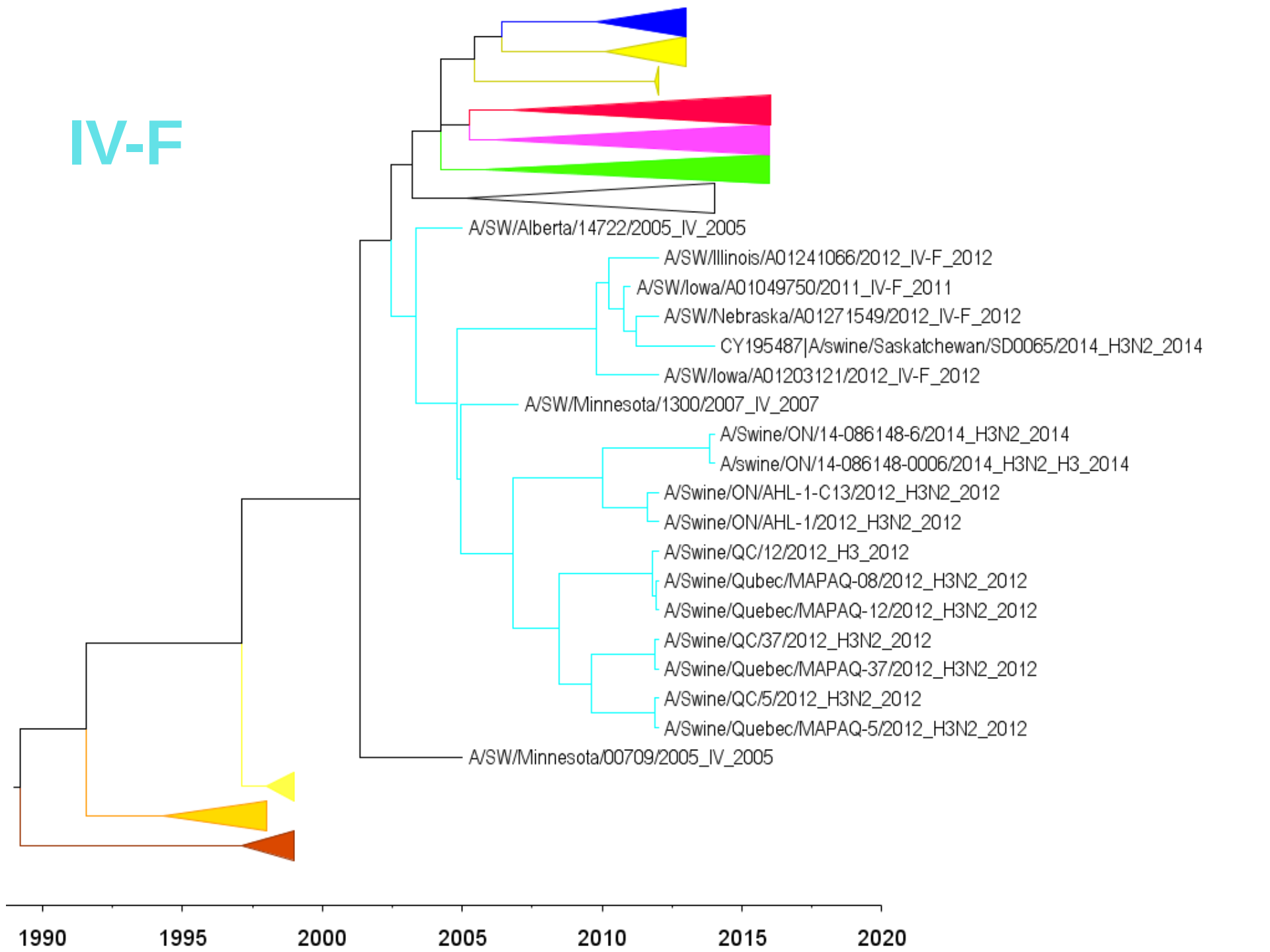
IV-G?

Groups	IV-B	IV-C	IV-D	IV-E	IV-F	IV-G
IV-B		6.7	6.3	6.2	6.6	7.1
IV-C			6.5	6.5	6.2	7.2
IV-D				6.2	6.4	6.9
IV-E					6.3	6.8
IV-F						7.2
IV-G						




IV-F
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A/Swine/Qubec/MAPAQ-08/2012_H3N2_2012
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A/Swine/QC/37/2012_H3N2_2012
A/Swine/Quebec/MAPAQ-37/2012_H3N2_2012
A/Swine/QC/5/2012_H3N2_2012
A/Swine/Quebec/MAPAQ-5/2012_H3N2_2012
A/SW/Minnesota/00709/2005_IV_2005
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Pandemic H1N1 in mink populations in Atlantic Canada

- Cases of pH1N1 were reported in mink in PEI and Nova Scotia
- Cases involved a number of farms and affected mainly mink kits
- Cases are most likely associated with influenza A contaminated feed originating from pigs
- Sero-surveillance of samples collected from mink in NS and NFLD
- Close to 50% serum samples from NS tested positive on ELISA
- HI assay – both H1 and H3 antibodies are present
- NFLD serum samples tested negative
- In NFLD mink aren't fed pig offal

H3N2v case in Ontario Nov. 2016

- Involved a 19 month old from rural Ontario
- Child was briefly hospitalized and later discharged
- Virus is different from the H3N2v viruses observed in US in 2011
- HA belongs to cluster IV-B in contrast to H3N2v viruses in USA which are IV-A

H3N2 cluster IVB circulating in Ontario	% identity similarity
A/Swine/ON/081606-0003/2016 (H3N2)	99.9
A/Swine/ON/088438-0023/2016 (H3N2)	99.8
A/Swine/ON/037836-0001/2016 (H3N2)	99.7
A/Swine/Ontario/097269-0006/2015 (H3N2)	99.6
A/Swine/ON/036545-0001/2016 (H3N2)	99.6
A/Swine/ON/063441-0009/2016 (H3N2)	99.6
A/Swine/ON/083519-0001/2016 (H3N2)	99.6

Gene segment constellations	
PB2	Pandemic
PB1	TRIG
PA	Pandemic
HA	TRIG
NP	Pandemic
NA	TRIG
M	Pandemic
NS	TRIG

Influenza Virus Aerobiology

- Collaborative Project
  - Dr. Samira Mubareka, Sunnybrook Health Sciences/Research Institute
  - Dr. Zvonimir Poljak, Population Medicine, University of Guelph
  - Dr. Harold Kloeze, CFIA
- Establish an animal and environmental sampling protocol for pigs
  - Oral fluids and flocked swabs
  - Evaluating 3 air samplers
    - GilAir Plus – low volume (3 litres/min) sampler
    - Anderson two stage air sampler – mid volume (28.3 litres/min) impaction sampler
    - SpinCon II – high volume (450 litres/min) cyclonic sampler
- Environmental determinants that affect virus survival in air
- Explore virus transmission at human-animal interface