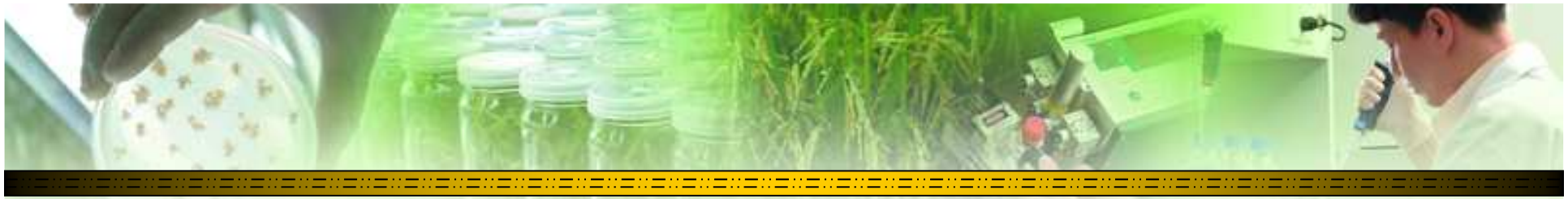


นวัตกรรมการออกแบบวัคซีนจากฐานข้อมูลไวรัสมหภาพของประเทศ

ดร. นันท์ชญา วรรณเสน

ห้องปฏิบัติการไวรัสวิทยาและเซลล์เทคโนโลยี

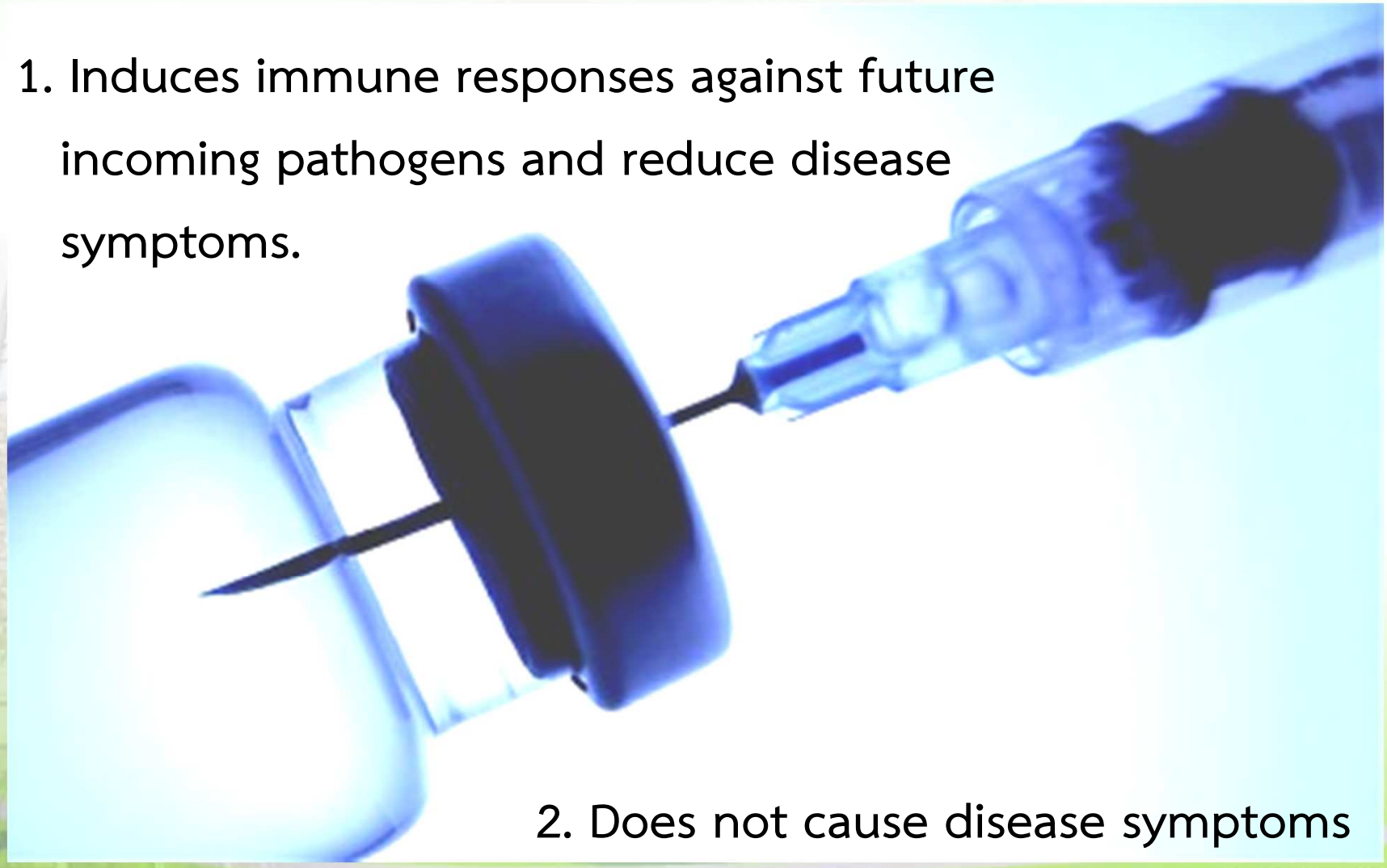
Vaccine

Vaccine

1. Induces immune responses against future incoming pathogens and reduce disease symptoms.

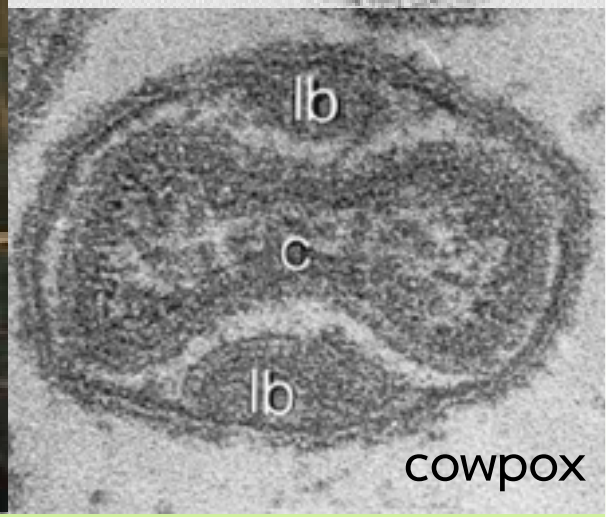
Vaccine

1. Induces immune responses against future incoming pathogens and reduce disease symptoms.



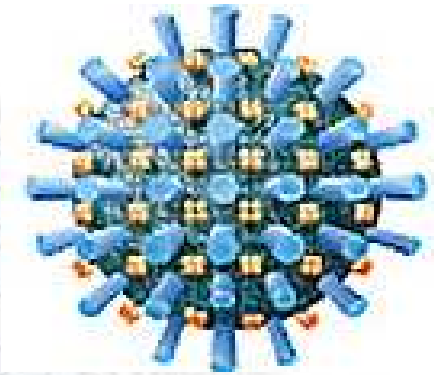
2. Does not cause disease symptoms

Vaccine 1.0

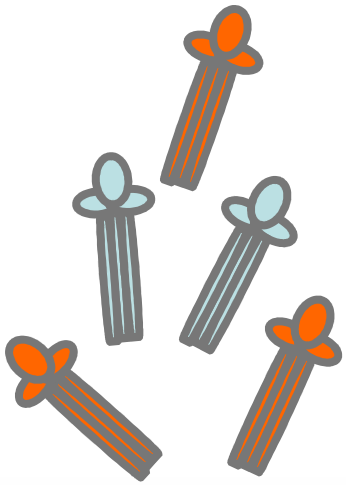


https://www.evolvingsciences.com/Vaccines%20.html

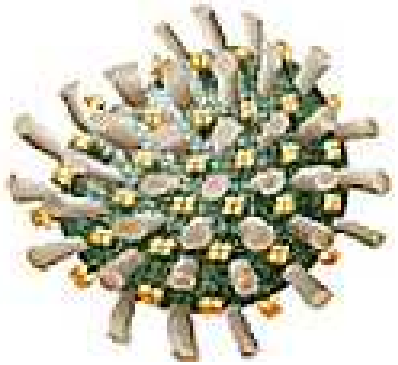
Vaccine 2.0



Inactivated Vaccine

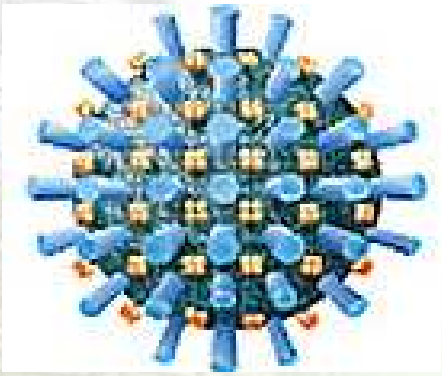


Subunit Vaccine



Live Attenuated Vaccine

Vaccine 2.0



Passage in cell culture

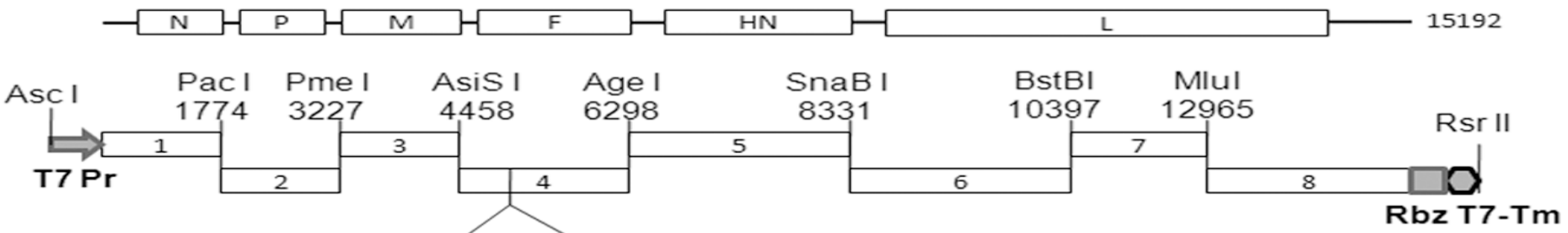
Virulent Pathogen

Live Attenuated Vaccine

Vaccine 3.0

reverse genetics & molecular tools

Vaccine 3.0



4483 to 4900

Newcastle Disease Virus

wt Ban/010	R agg	R aga	Q cag	K aaa	R ↓ cgc	F ttt	(Virulent F cleavage site)
Ban/AF	G ggg	R aga	Q cag	G ggg	R ↓ cgc	L ctt	(Avirulent F cleavage site)

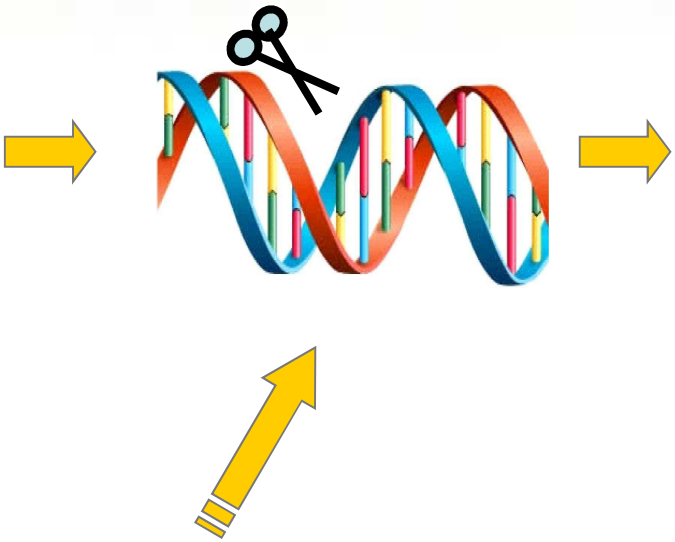
	Parental Ban/010	Recombinant Ban/010	Ban/AF			B1	LaSota
			Passage 3 in brain	Passage 10 in eggs[a]	Passage 10 in chicks[b]		
MDT	52	51	>120 h	>120 h	>120 h	>120 h	116
ICPI	1.88	1.88	0.00	0.00	0.00	0.00	0.40

a, Virus was passaged in 1-day-old chicken brain for 3 times. b. Virus was passaged in 9-day-old embryonated chicken eggs for 10 times. c, Virus was passaged through oculonasal route in 1-day-old chicks for 10 times.

doi:10.1371/journal.pone.0052751.t004

Xiao S, et al. PLoS One. 2012; 7(12)

Vaccine 4.0

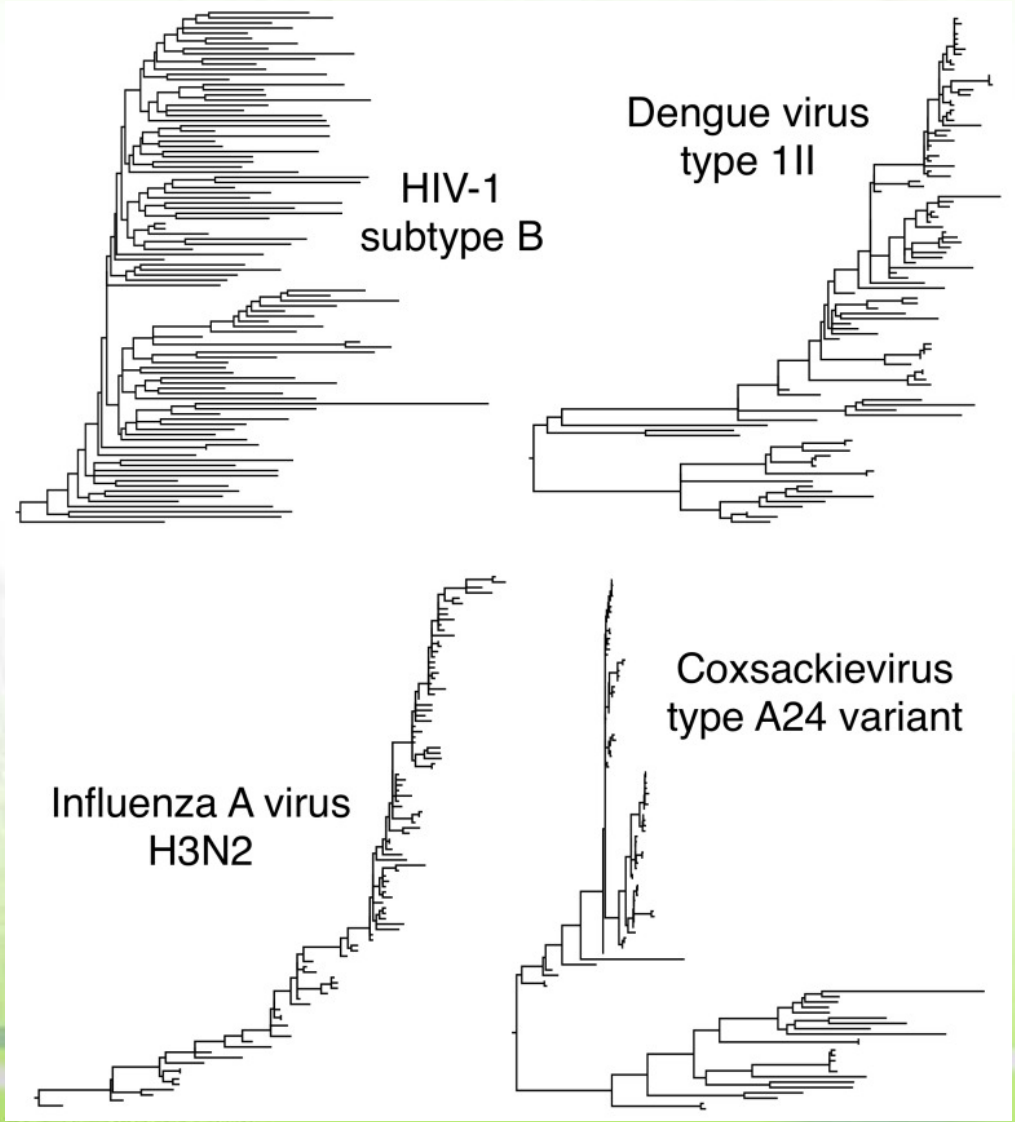


Data Technology Era

High throughput data acquisition

Next generation sequencing

Virus Diversity

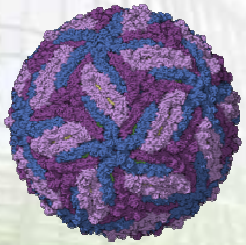


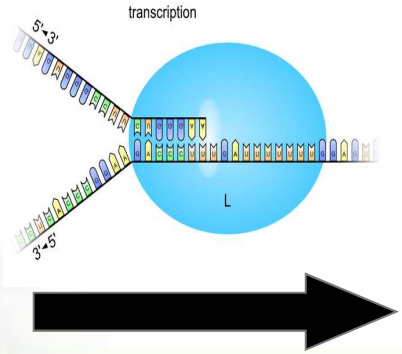
Poon AF, et al. PLos One 2013 Nov 1;8(11)

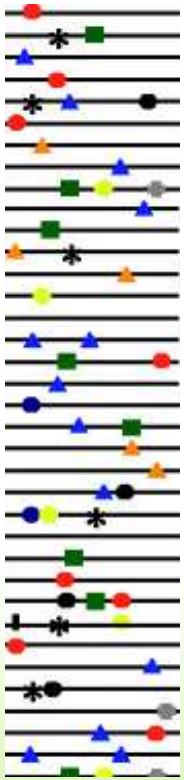
RNA viruses

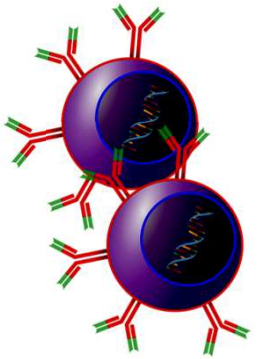
Low fidelity

RNA polymerase





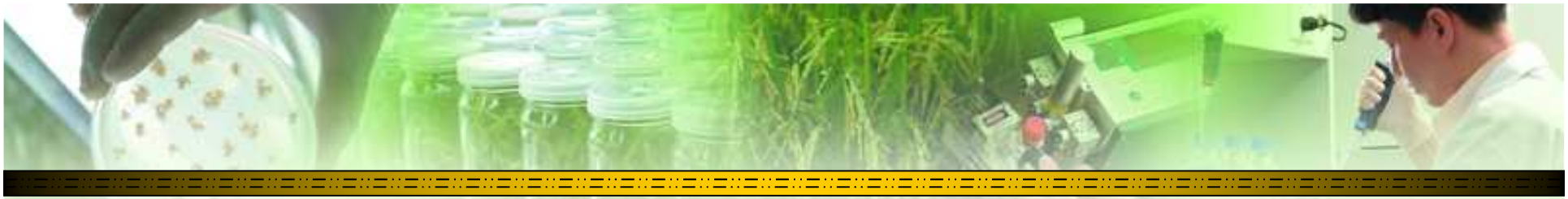




Escape

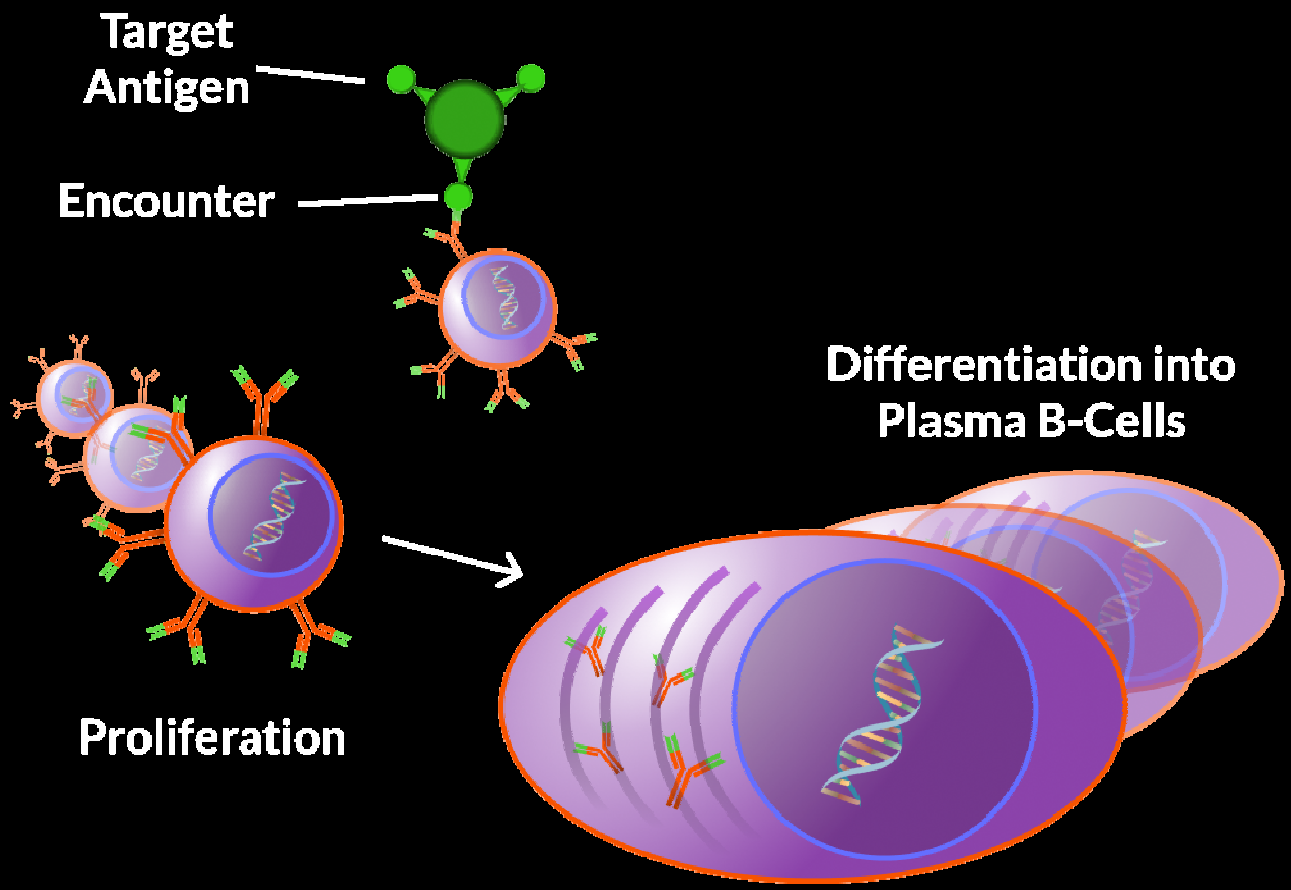
immune system

Quasispecies



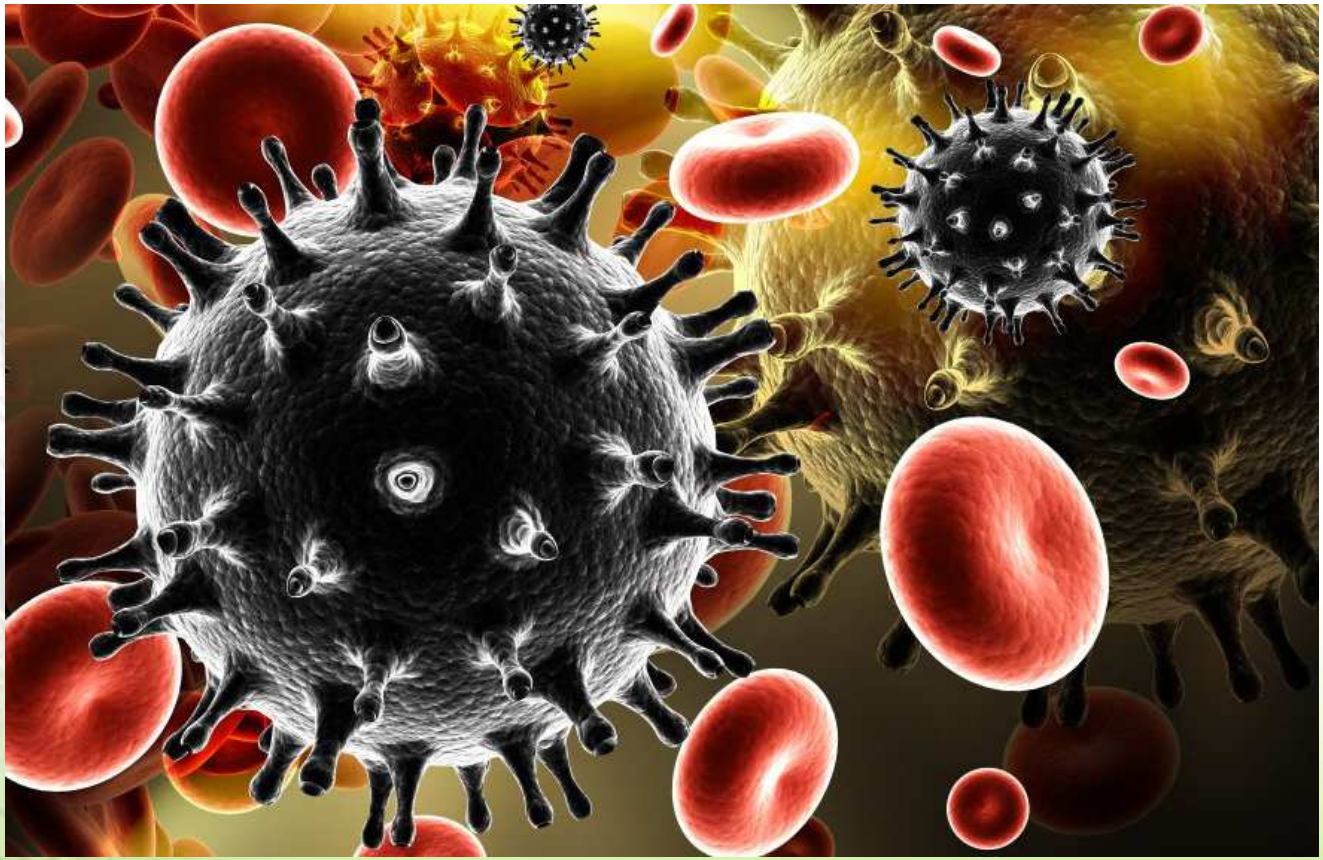
Lessons Learned from Human Vaccines

The Goal of Vaccination is to Educate Immune System



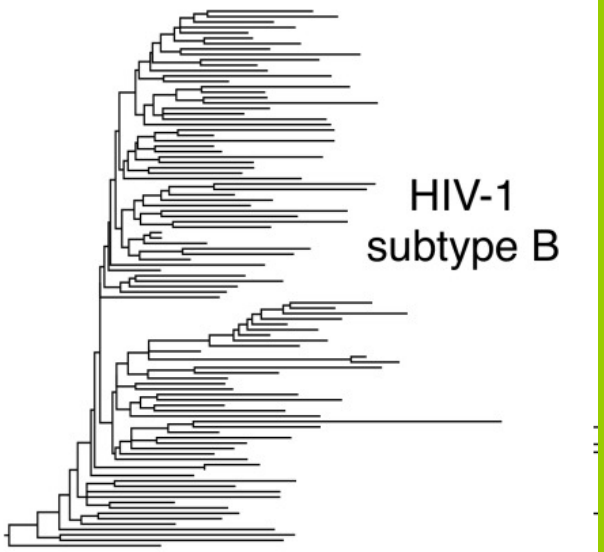
http://www.trellisbio.com/science.html

HIV Vaccine Research

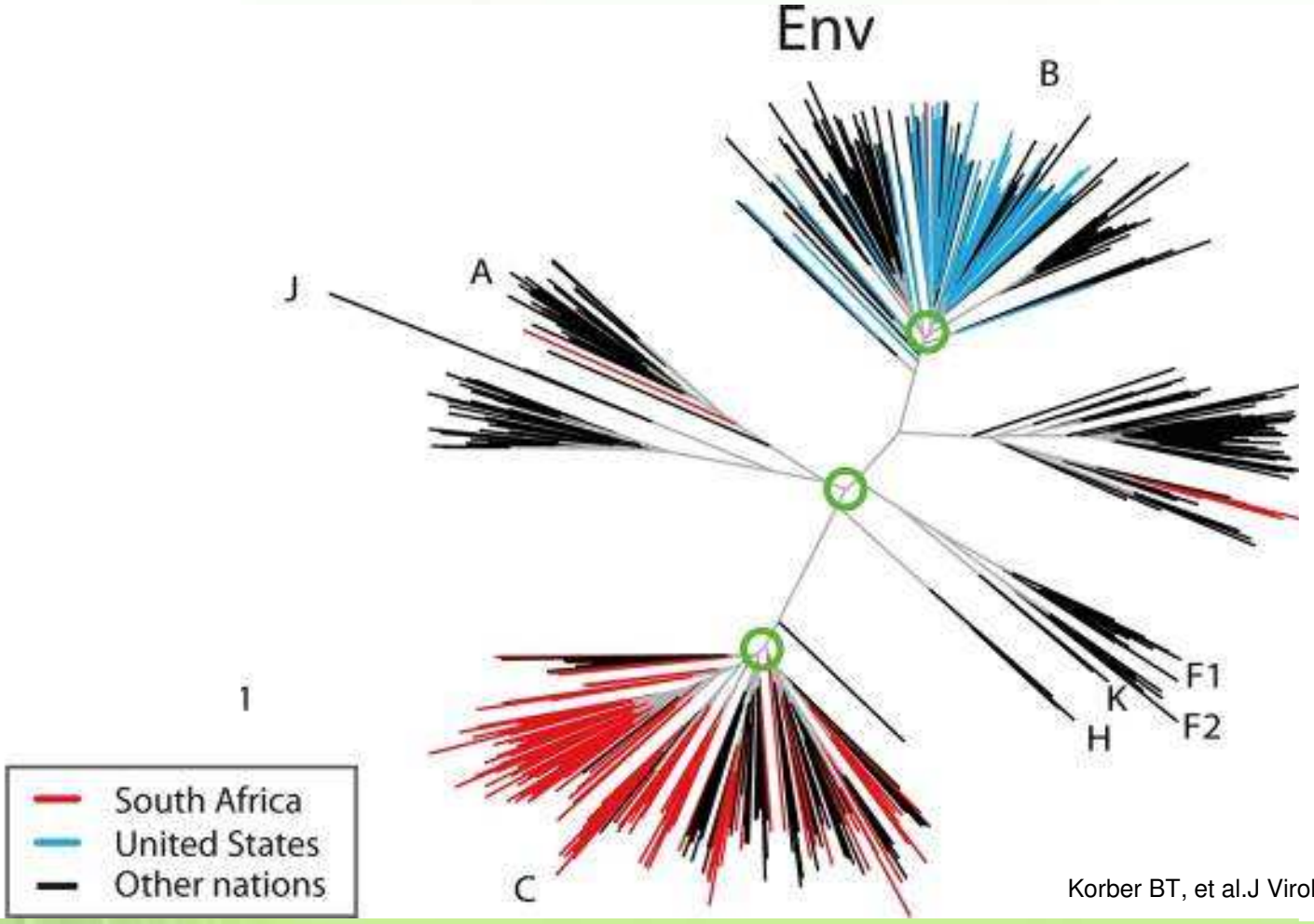


HIV

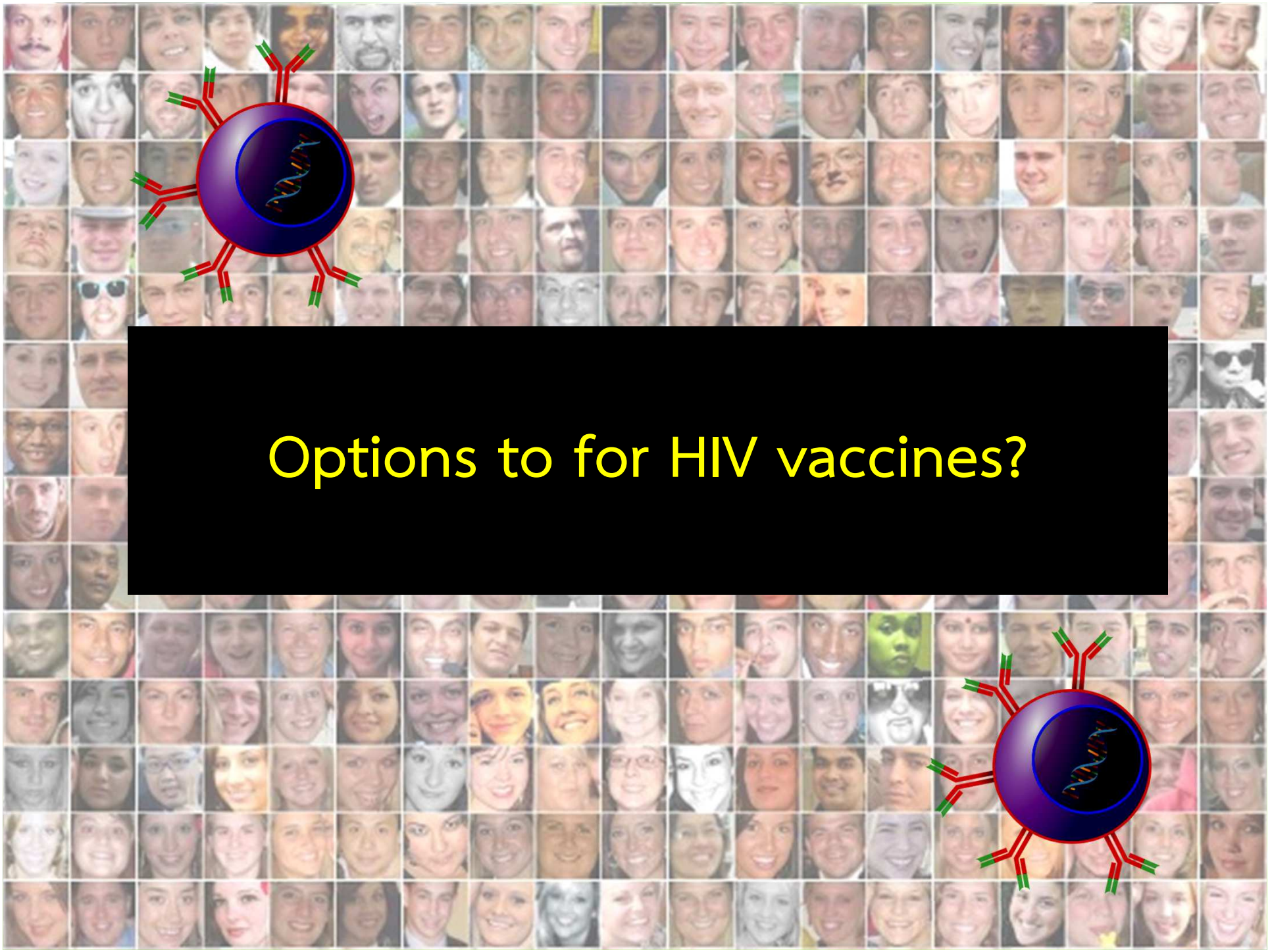
The Virus With a Thousand Faces



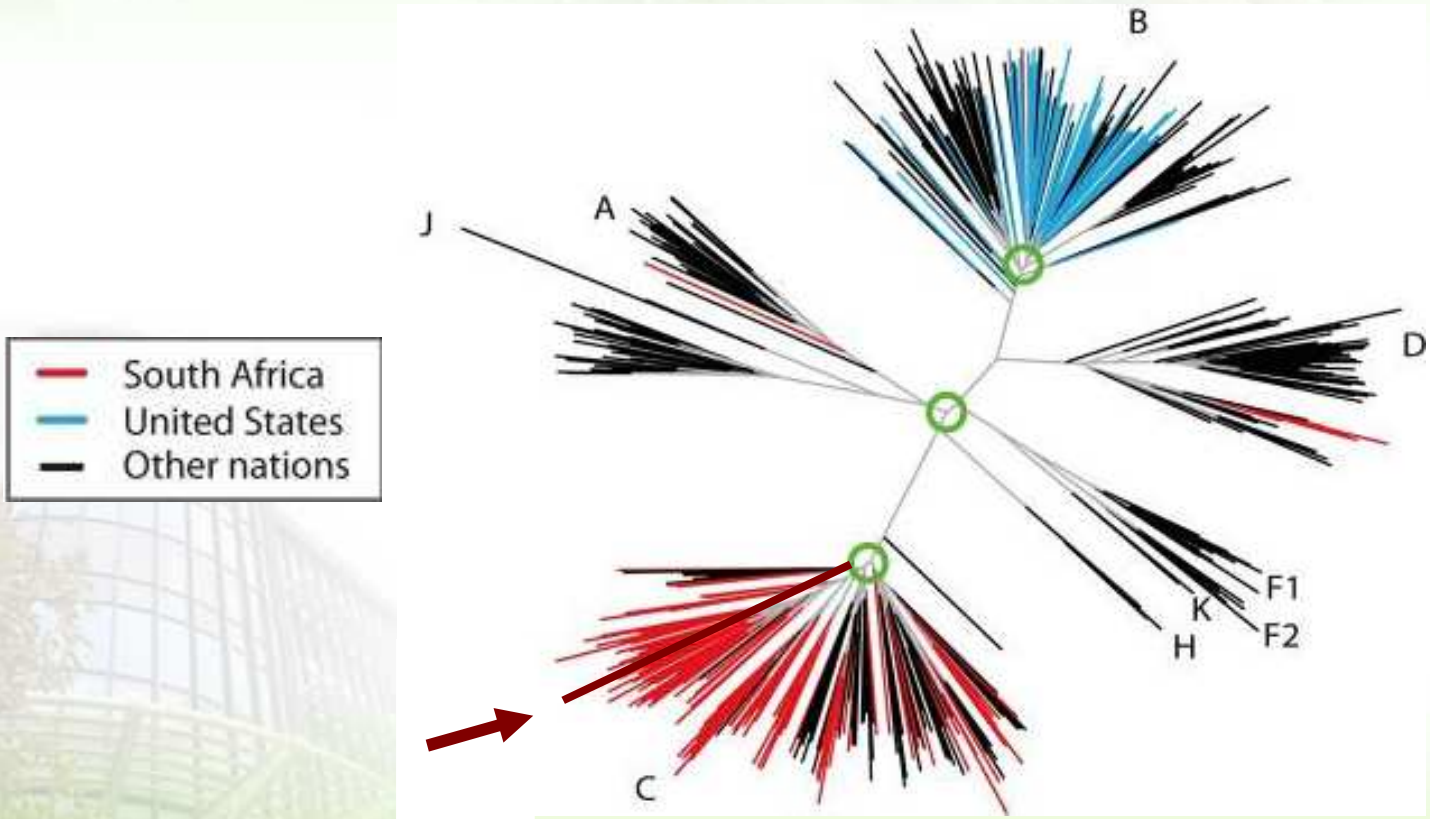
Various Strains of HIV



Korber BT, et al.J Virol.83(17):8300-8314

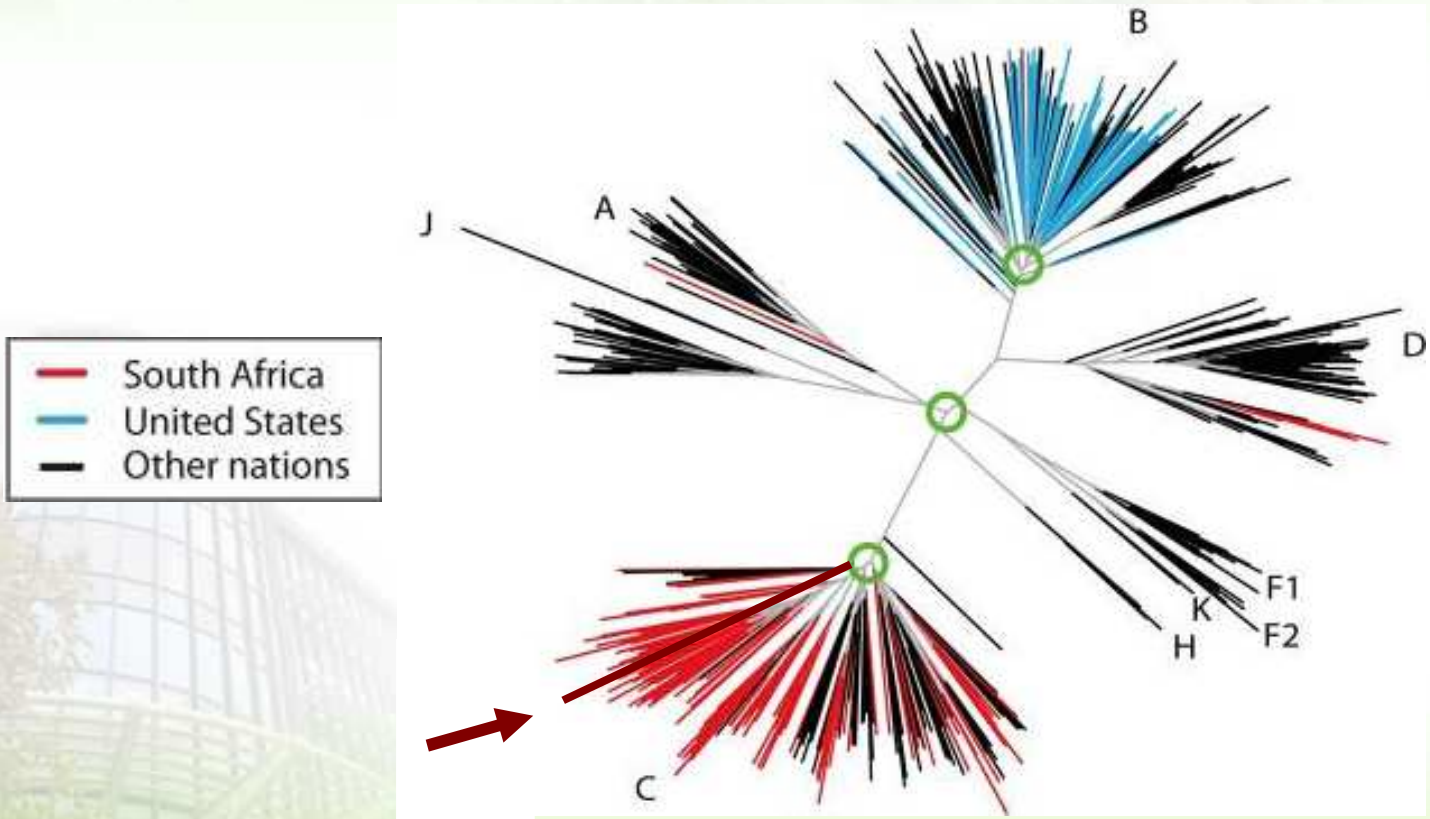

Options to for HIV vaccines?

Option 1: Country-Specific Vaccine



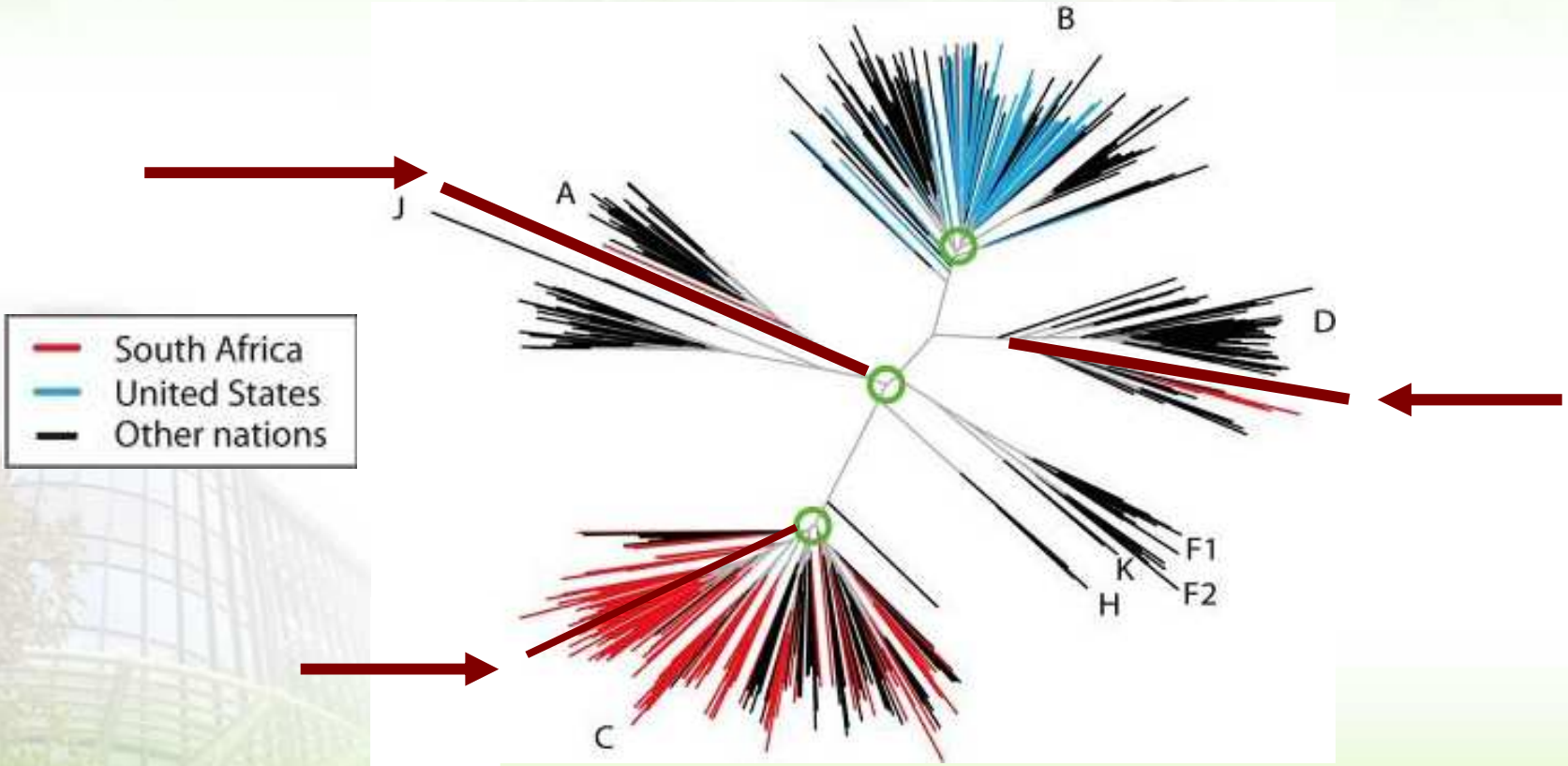
1. Cannot cover all strains
2. Each region needs funding for vaccine testing

Option 2: Subtype-Specific Vaccine



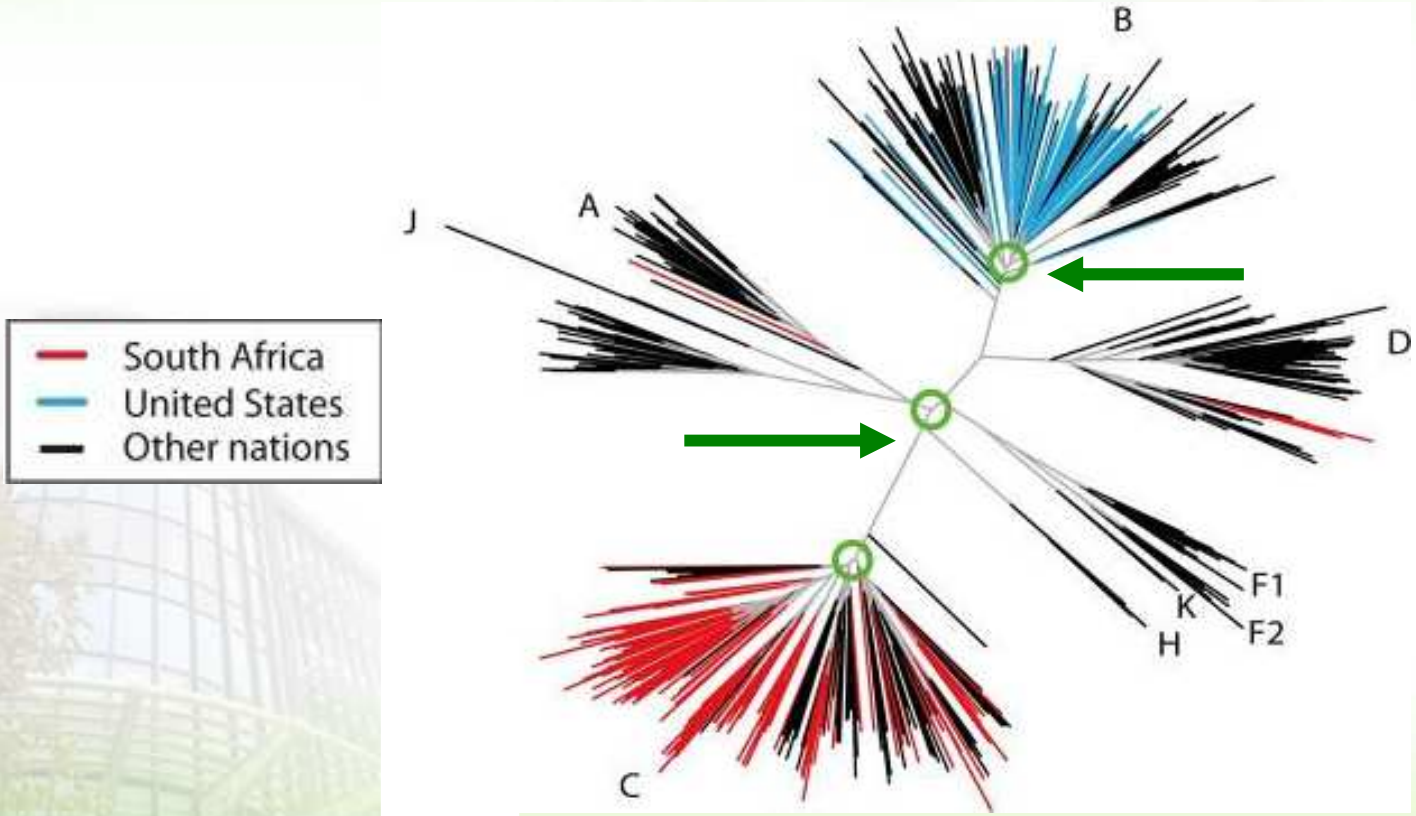
1. Cannot cover all strains
2. Each region needs funding for vaccine testing

Option 2: Polyvalent Vaccine



1. Cover more strains
2. Higher cost to produce 3 strain-cocktail

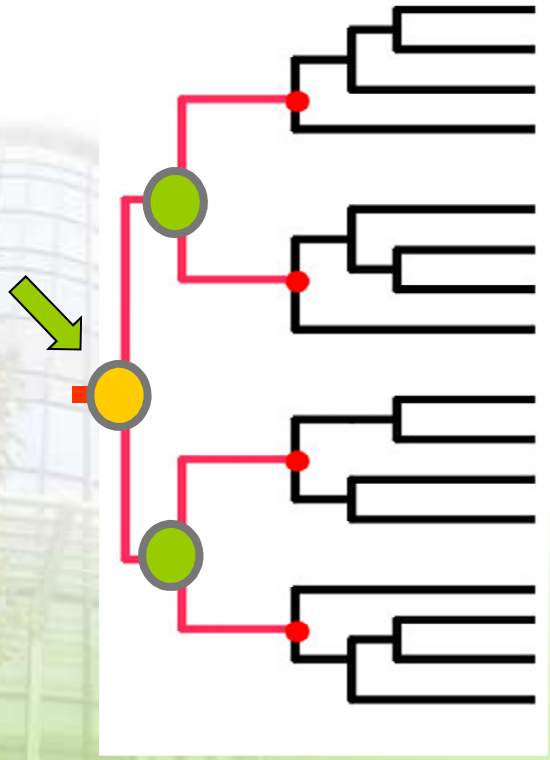
Option 3: Centralized Vaccine



1. Cover <u>EVEN</u> more strains
2. Lower cost to produce 1-strain vaccine

Option 3: Centralized Vaccine

Ancestral Sequence



Consensus Sequence

Consensus 124 Sequences	ATGTTGGGGAAATGCTTGACCGCGGGCTGTTGCTCG
	10 20 30
NA_TH_SKW194_201	ATGTTGGGGAAATGCTTGACCGCGGGTTGTTGCTCG
NA_TH_CCO018_201	ATGTTGGGGAAATGCTTGACCGCGGGTTGTTGCTCG
NA_TH_CMI109_201	ATGTTGGGGAAATGCTTGACCGCGGGCTGTTGCTCG
NA_TH_CNT039_201	ATGTTGGGGAAATGCTTGATCGCGGGCTATTGCTCA
NA_TH_CNT040_201	ATGTTGGGGAAATGCTTGATCGCGGGCTATTGCTCA
NA_TH_LRI126_201	ATGTTGGGGAAATGCTTGACCGCGGGCTGTTGCTCG
NA_TH_NMA122_201	ATGTTGGAGAAATGCTTGACCGCGGGCTGTTGCTCG
NA_TH_NYK001_200	ATGTTGGGGAAATGCTTGATCGCGGGCTATTGCTCG
NA_TH_NYK004_200	ATGTTGGGGAAATGCTTGACCGCGGGCTGTTGCTCG
NA_TH_RNG019_201	ATGTTGGGGAAATGCTTGACCGCGGGCTGTTGCTCG
NA_TH_SKA233_201	ATGTTGGGGAAATGCTTGATCGCGGGCTATTGCTCA
NA_TH_SKW011_201	ATGTTGGGGAAATGCTTGATCGCGGGCTATTGCTCG

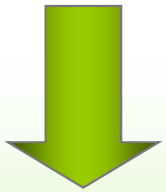
Concerns

Are these non-natural proteins functional?

Is the virus with consensus sequence infectious? (live att. vaccine)

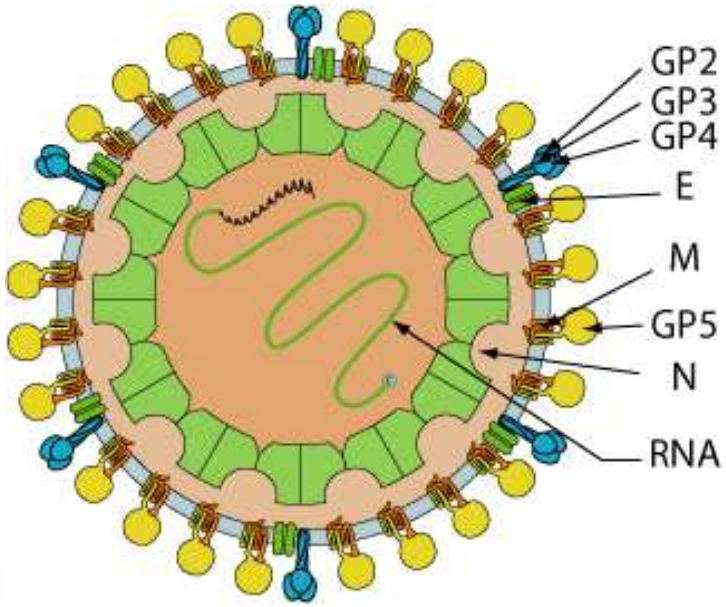
Is the protein immunogenic? (subunit vaccine)

Is the induced immune response cross-protective?

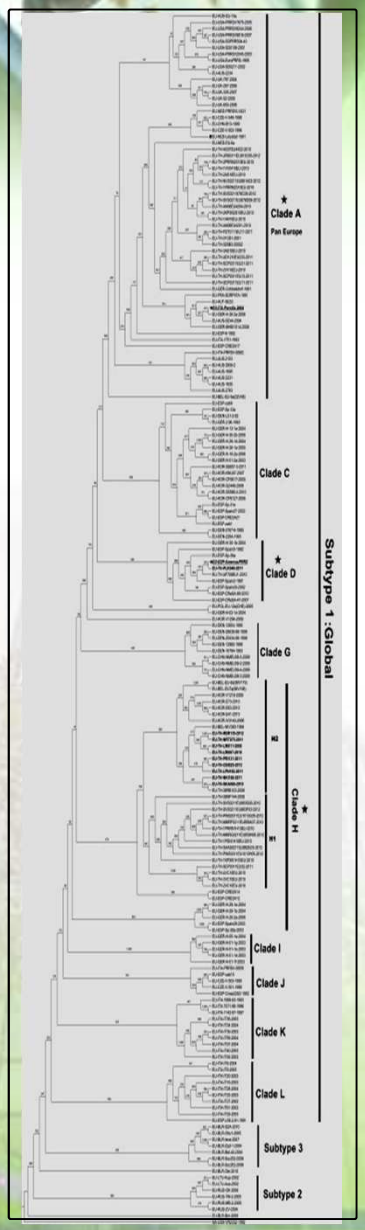


In vivo tests

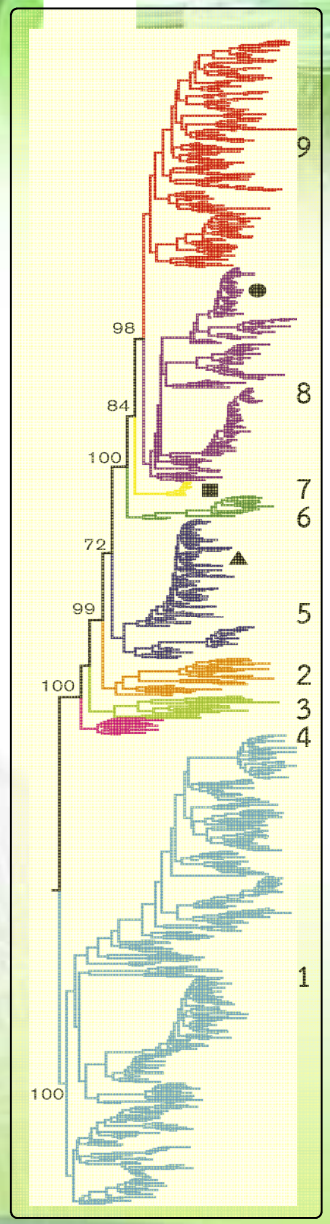
Animal Vaccines: PRRSV



PRRSV



Jantafong et. al. 2015



Singh Brar et. al. 2015

PRRSV

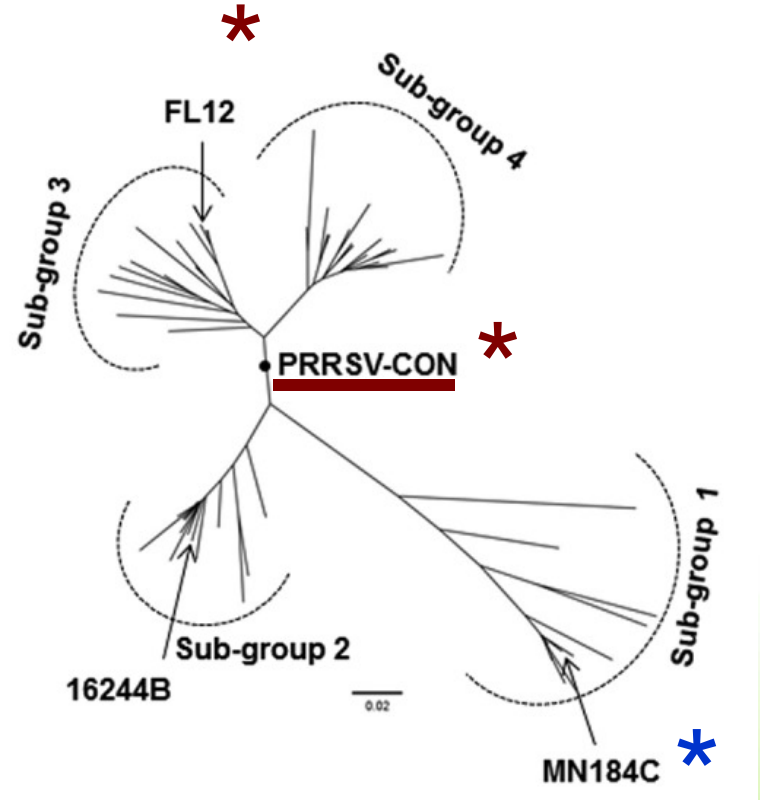
Type I: European (EU)

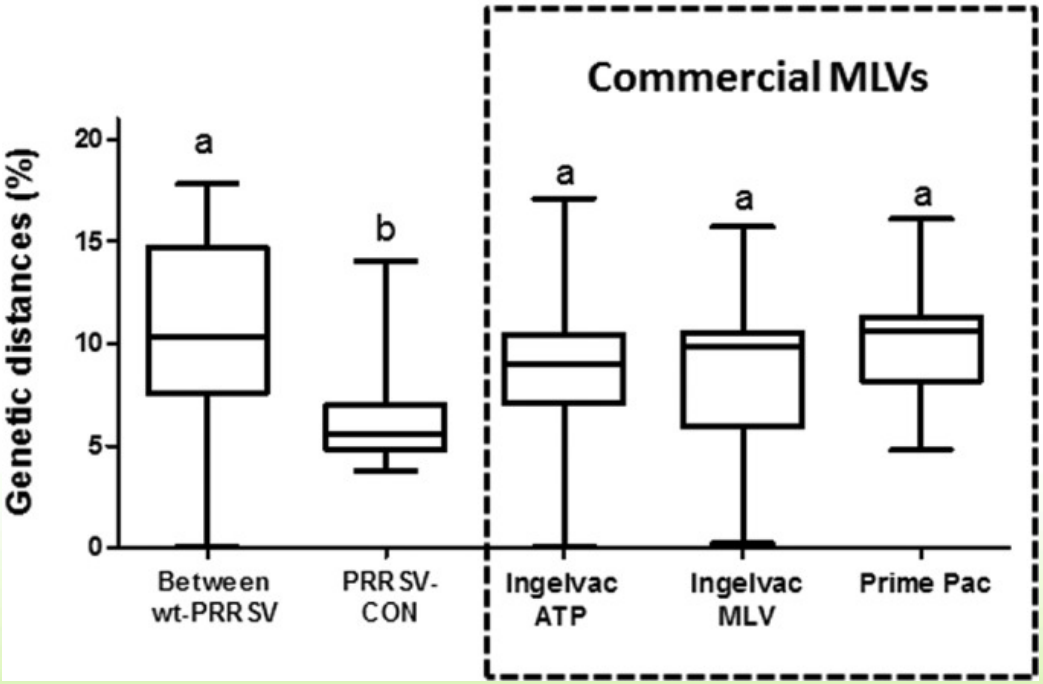
- 4 Subtypes

Type II: North American (NA)

- 9 Lineages

Animal Vaccines: PRRSV

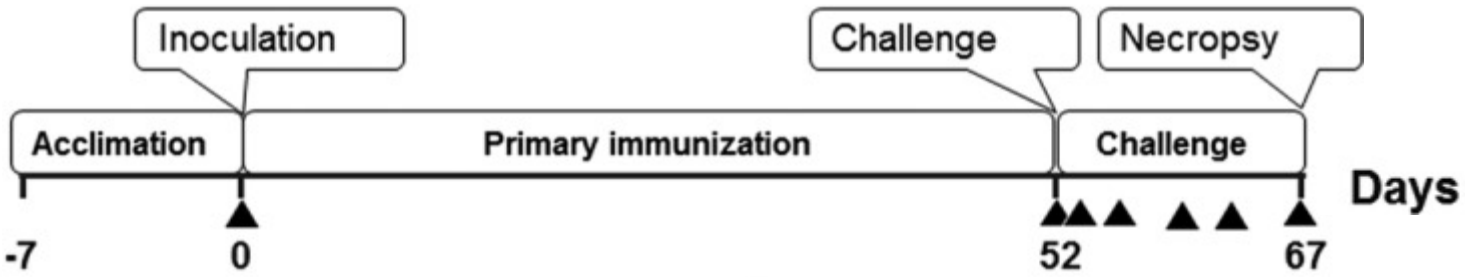


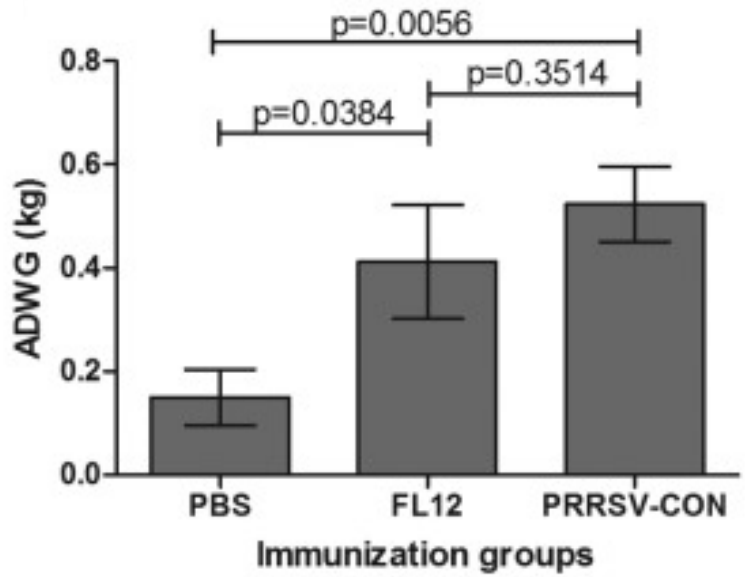


Vu et. al. J Virol. 2015. 89(23): 12070-12083

Animal Vaccines: PRRSV

FL12, PRRSV-CON **MN-184**

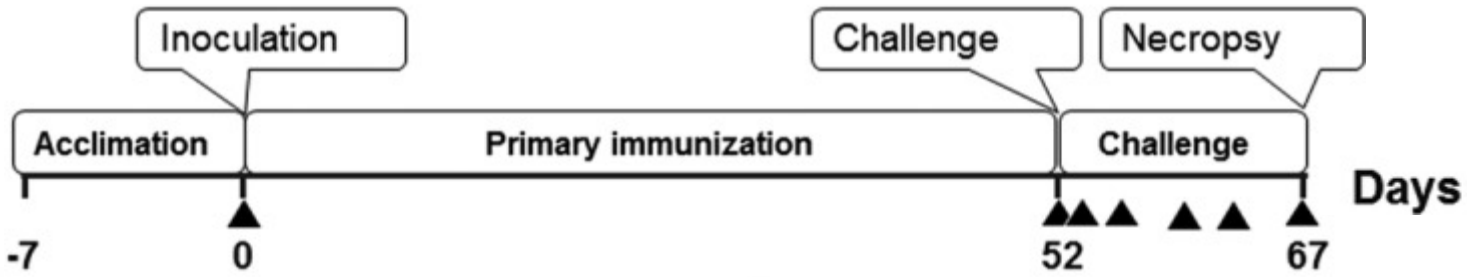


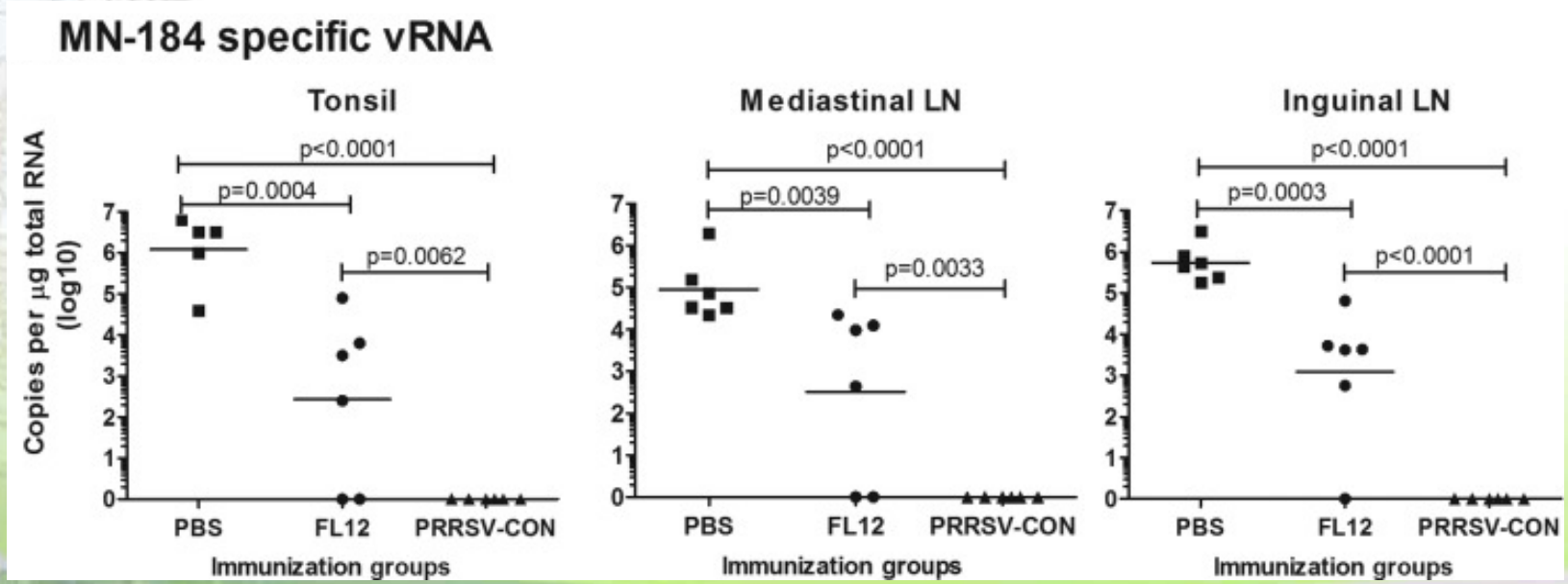


Vu et. al. J Virol. 2015. 89(23): 12070-12083

Animal Vaccines: PRRSV

FL12, PRRSV-CON **MN-184**

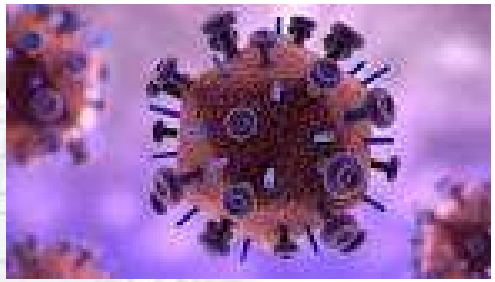




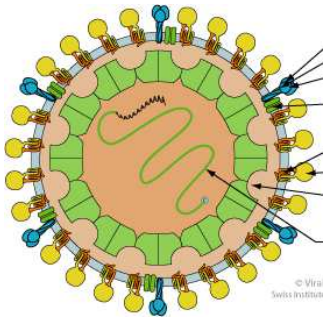
Vu et. al. J Virol. 2015. 89(23): 12070-12083

Tested Models

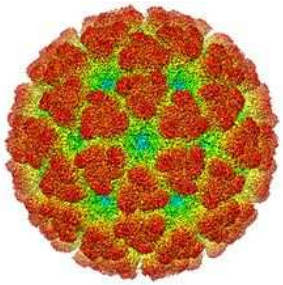
HIV



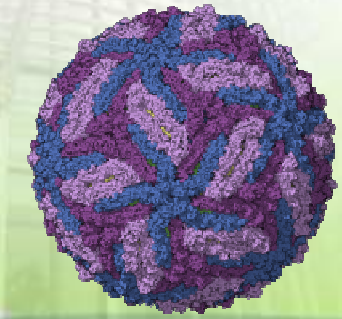
PRRSV



Chikungunya virus



Zika Virus



Influenza virus

Ebola virus

Future Vaccines for Smart Farms