Australian “novel” H1N2 and H3N2 SOIVs:

A/swine/WA/2012/2111/H1N2

PB2	A/Singapore/GP1132/2009(H1N1)
PB1	A/Russia/165/2009(H1N1)
PA	A/Ontario/9698/2009(H1N1)
HA	A/Lackland/3/1978(H1N1)
NP	A/Singapore/GP4610/2010(H1N1)
NA	A/Hong Kong/46/1971(H3N2)
MP	A/swine/Brazil/12A/2010(H1N1)
NS	A/swine/Brazil/12A/2010(H1N1)

A/swine/WA/2012/2577766G/H3N2

PB2	A/Queensland/7/70(H3N2)
PB1	A/Finland/381/1995(H3N2)
PA	A/Baylor/11735/1982(H1N1)
HA	A/New York/652/1996(H3N2)
NP	A/Taiwan/2/70(H3N2)
NA	A/New York/652/1996(H3N2)
MP	A/Chiba/5/71(H3N2)
NS	A/Chiba/5/71(H3N2)

A/swine/Queensland/2012/1321-2/H1N2

PB2	A/San Diego/INS62/2009(H1N1)
PB1	A/Singapore/ON1892/2009(H1N1)
PA	A/Singapore/GP1146/2009(H1N1)
HA	A/Memphis/7/1996(H1N1)
NP	A/Managua/3244.01/2009(H1N1)
NA	A/Queensland/37/2003(H3N2)
MP	A/Headington/INS3_635/2011)
NS	A/Karasuk/01/2010(H1N1)

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Western Australian H1N2 and H3N2 genotypes reisolated from same large piggery in December 2016

Number of residue aa substitutions between 2012 and 2016 (98-99% seq similarities)

Virus	Year	PB2	PB1	PA	HA	NP	NA	M	NS
H1N2 WA	2012 vs 2016	6	4	4	7	5	7	0	1
H3N2 WA	2012 vs 2016	4	5	5	12	1	7	1	5

Green – Human origin H3N2 (*circa.* 197 -1990's)

Blue – Human origin H1N1 (*circa.* 1980's)

Yellow – pandemic H1N1 (post-2009)

Updated HI Assay – only reactive titres shown

Reference Antisera tested:

Swine H1	Human H1	Swine H3	Human H3
A/Swine/Wisconsin/1/196830/1968 (H1N1)	A/NewJersey/8/76 (H1N1)	A/Swine/Colorado/23619/1999 (H3N2)	A/Port Chalmers/1/1973 (H3N2)
A/Swine/Iowa/1973 (H1N1)	A/Solomon Islands/3/2006 (H1N1)	A/Swine/NakornPathom/2002 (H3N2)	A/Bangkok/01/1979 (H3N2)
A/Swine/Kentucky/02086/2008 (H1N1)	A/New Caledonia/20/1999 (H1N1)	A/Swine/Iowa/A01480656/2014 (H3N2)	A/Shanghai/11/87 (H3N2)
A/Swine/Minnesota/02011/2008 (H1N2)	A/California/04/2009 (H1N1)		A/Moscow/10/1999 (H3N2)
A/Swine/Illinois/00685/2005 (H1N1)	A/California/04/2009 (H1N1)		A/Fujian/411/2002 (H3N2)
A/Swine/Ohio/511445/2007 (H1N1)			A/Brisbane/10/2007 (H3N2)
A/Swine/QLD/2476-6/2012 (H1N2)			A/Victoria/361/2011 (H3N2)
A/Swine/WA/2577896X/2012 (H1N1)			A/Switzerland/9715293/13 (H3N2)

Results for Australian SOIV:

A/Swine/WA/2577766G/2012 (H3N2)	
A/Swine/Minnesota/01146/2006 (H3N2)	640
A/Wuhan/359/1995 (H3N2)	320
A/Swine/Texas/4199-1/1998 (H3N2)	320
A/Swine/New York/A01104005/2011 (H3N2)	40
A/Beijing/32/92 (H3N2)	40
A/Sydney/5/1997 (H3N2)	20
A/Swine/WA/2577766G/2012/H3N2	1280

NB: HA gene blasts to **A/New York/652/1996 (H3N2)**

A/swine/WA/2577896X/2012 (H1N2)	
A/swine/QLD/1321/2012 (H1N2)	40
A/swine/WA/2577896X/2012 (H1N2)	640

NB: HA gene blasts to **A/Memphis/2/1983 (H1N1)**

A/Swine/QLD/1321/2012 (H1N2)	
A/Sw/WA/2577896X/2012 (H1N2)	20
A/Sw/QLD/1321/2012 (H1N2)	640

NB: HA gene blasts to **A/Memphis/7/1996 (H1N1)**

The Australian novel H1N2 viruses are antigenically unrelated to swine and human H1 antigens in the above panel

Current studies

Characterise these viruses in terms of pathogenesis and zoonotic potential:

- Determine the **zoonotic potential** of novel Australian influenza A viruses using the **ferret model of disease**
- Determine **the extent of disease** caused by novel Australian influenza A viruses in the **host species**, **pigs**
- Determine **infectivity and growth characteristics** of the novel Australian SIV isolates ***in vitro***

Investigate molecular determinants of infectivity and pathogenicity of the novel Australian influenza A viruses

- Based on *in vitro* and *in vivo* results

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Characterisation of two Australian SOIV in ferrets and pigs :

	Ferrets		Pigs	
	A/sw/WA/2012/H3N2	A/sw/QLD/2012/1321 H1N2	H3N2	H1N2
URT Clinical signs	Yes; 2 DPI + weight loss + fever	Yes; 2 DPI +fever	Yes; bacterial only, day 4 PI	No
Histopathology	Yes; 3 DPI	Yes; 3 DPI	Yes; 5 DPI	No
TCID50 nasal wash peaks	1 and 5 DPI	1 and 5 DPI	2 and 5 DPI	2 and 5 DPI
VI Respiratory Tissues (1-5 DPI)	Yes; trachea, outer lungs, inner lungs	Yes; trachea, outer lungs, inner lungs	Yes; trachea, outer lungs, inner lungs	Yes; trachea, outer lungs, inner lungs
VI Extra respiratory tissues (1-5 DPI)	Yes; heart muscle	Yes; heart muscle	Yes; bronchial LN, tonsil	Yes; bronchial LN, tonsil, cerebrum
Mutation HA gene	No	Yes; 222 G→D	No	Yes; 222 G→D
Seroconversion	1:1280 14 DPI	1:1280 14 DPI	1:1280 14 DPI 1:80 9 DPI	1:1280 14 DPI

Notes/Ongoing:

- MDCK cell line has dysfunctional interferon type 1 response. Perhaps NS gene is playing a role in ability to grow in other cell lines

<u>Soon to complete:</u>

- Growth curves for WA and QLD based reassortant H1N2 viruses
- Interferon ELISA
- Polymerase activity assays
- Ferret trial to confirm increased weight loss for the altered QLD virus phenotype