

Molecular arms races between primate and viral genomes

Part 2:
Viral Evolution

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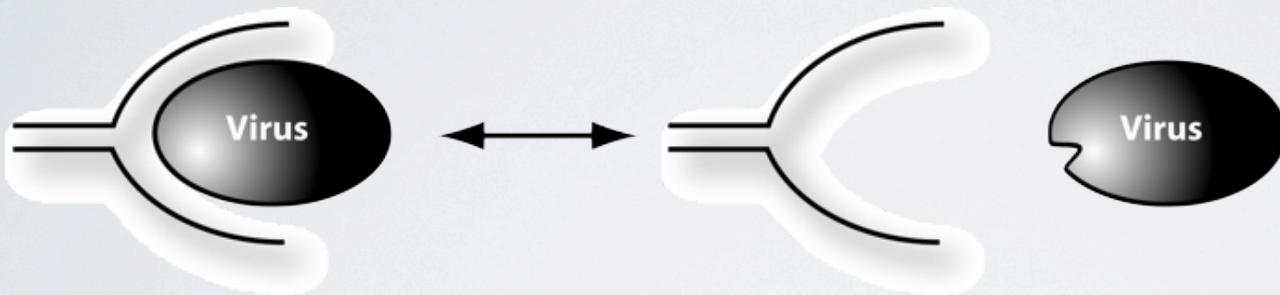
The Red Queen: “It takes all the running you can do, to keep in the same place.”

--Lewis Carroll,
“Through the Looking Glass”

The Red Queen Hypothesis: “For an evolutionary system, continuing development is needed just in order to maintain its fitness relative to the systems it is co-evolving with.”

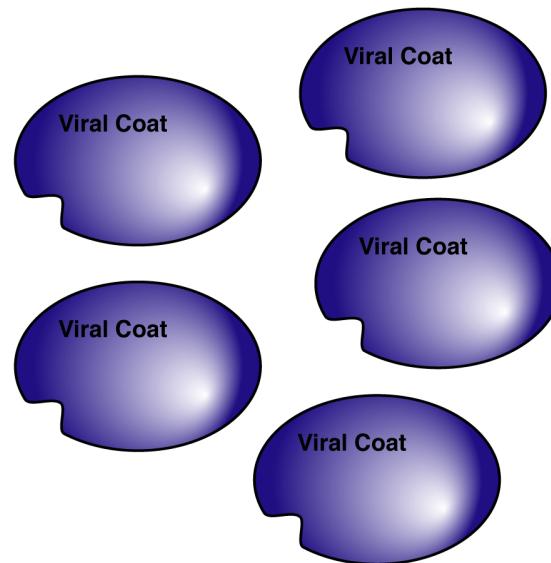
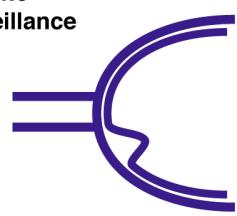
--Leigh Van Valen (1973)

...the usual suspects

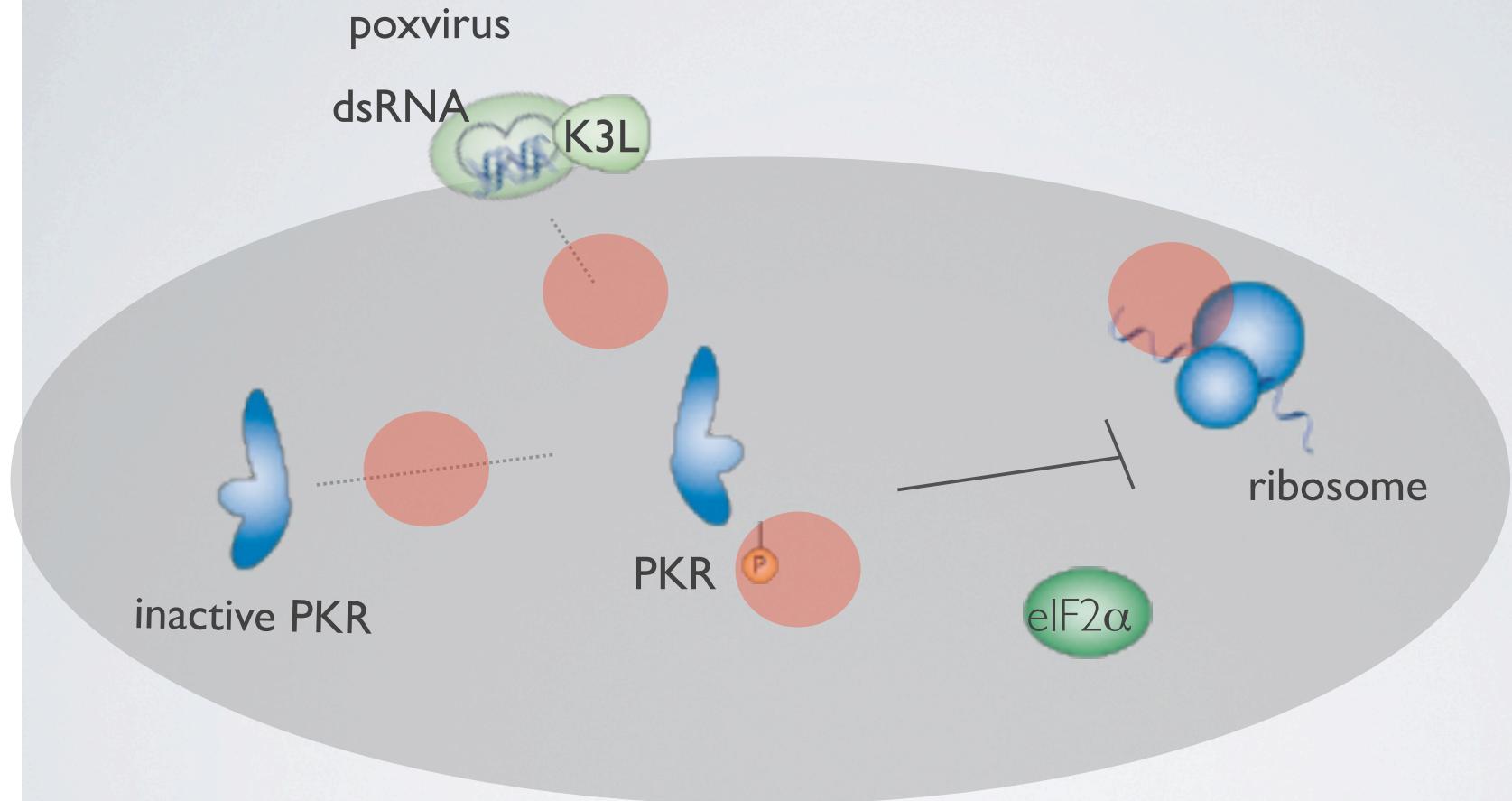


One party is always 'losing'.
There is always an evolutionary advantage
to be gained by innovation

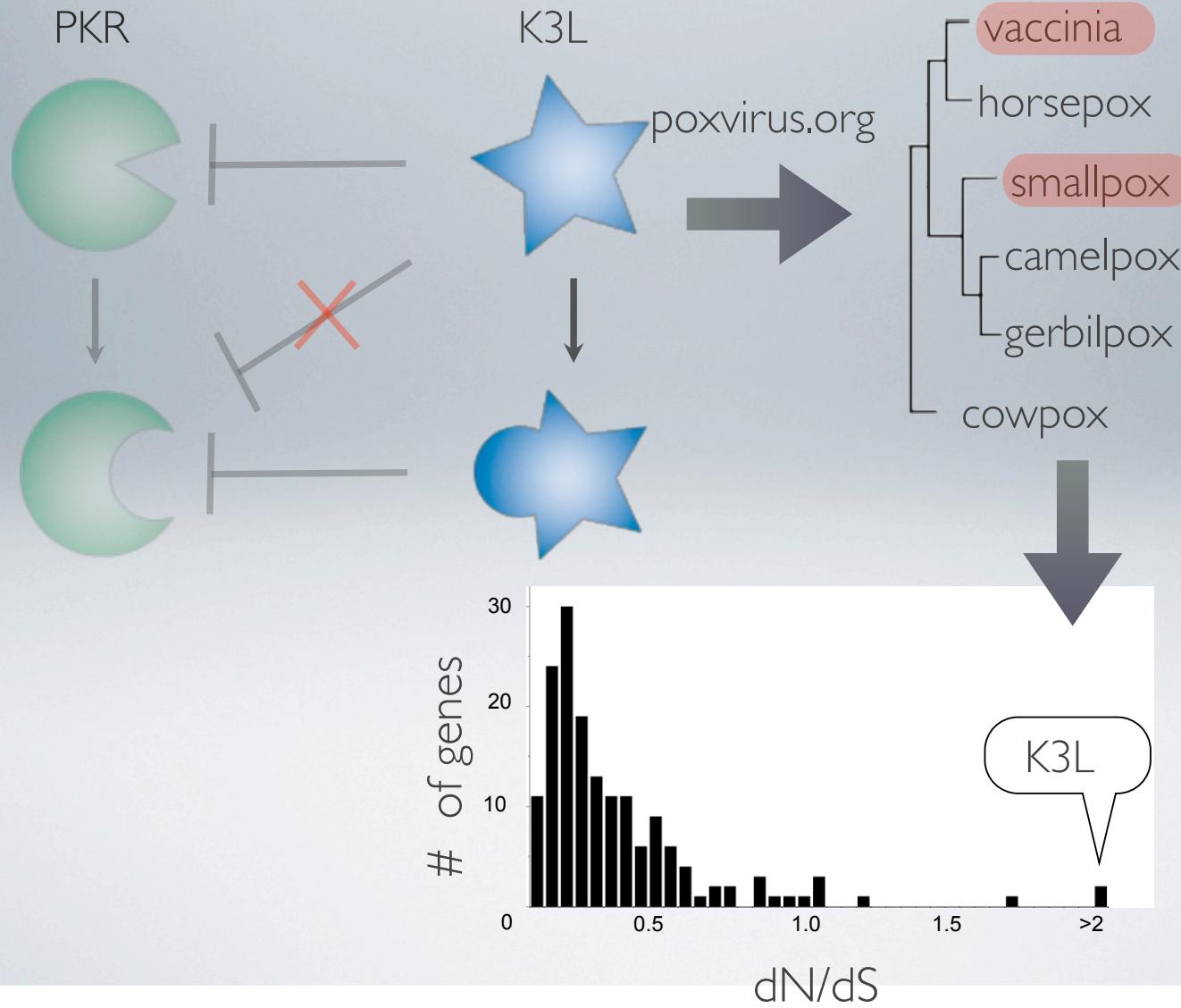
Immune
Surveillance



protein kinase r (PKR)

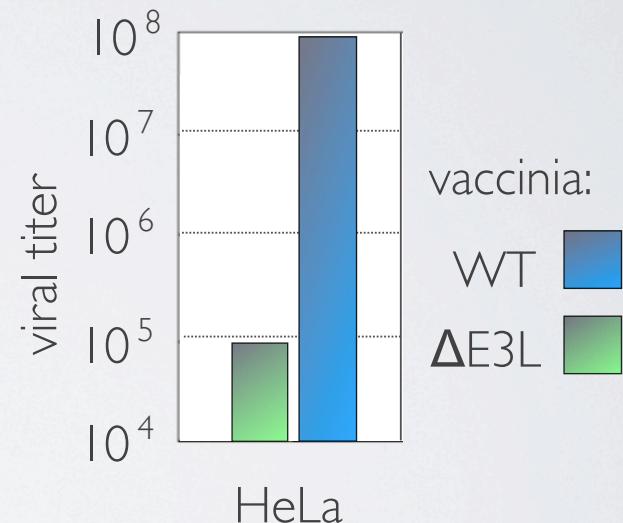
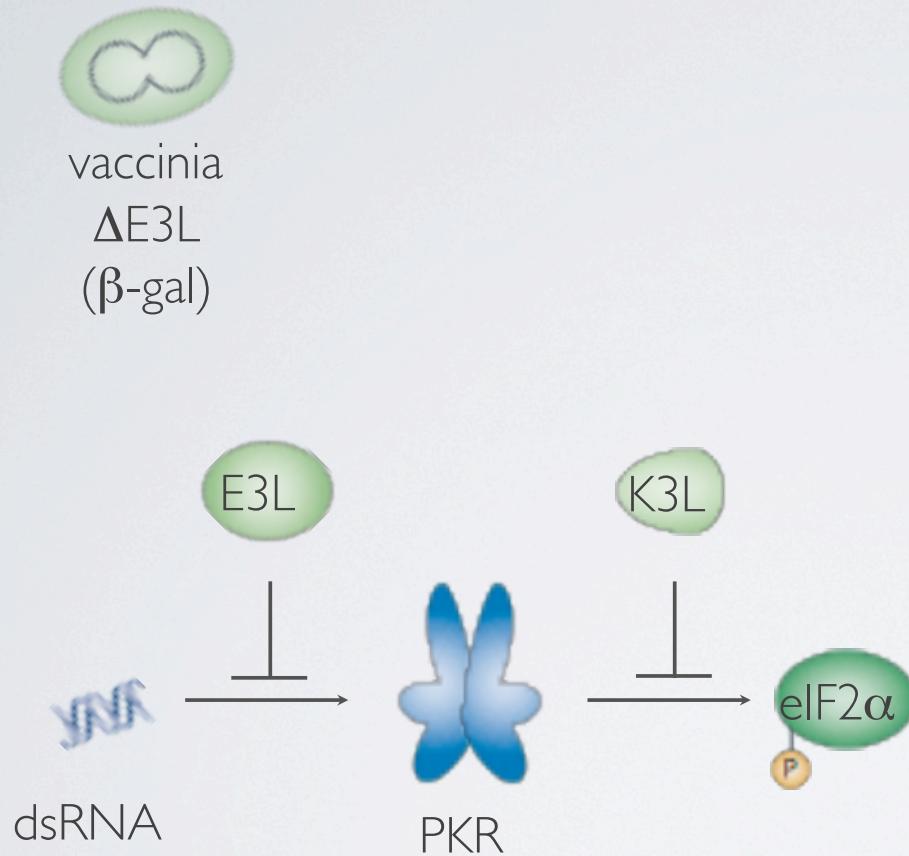


PKR versus K3L



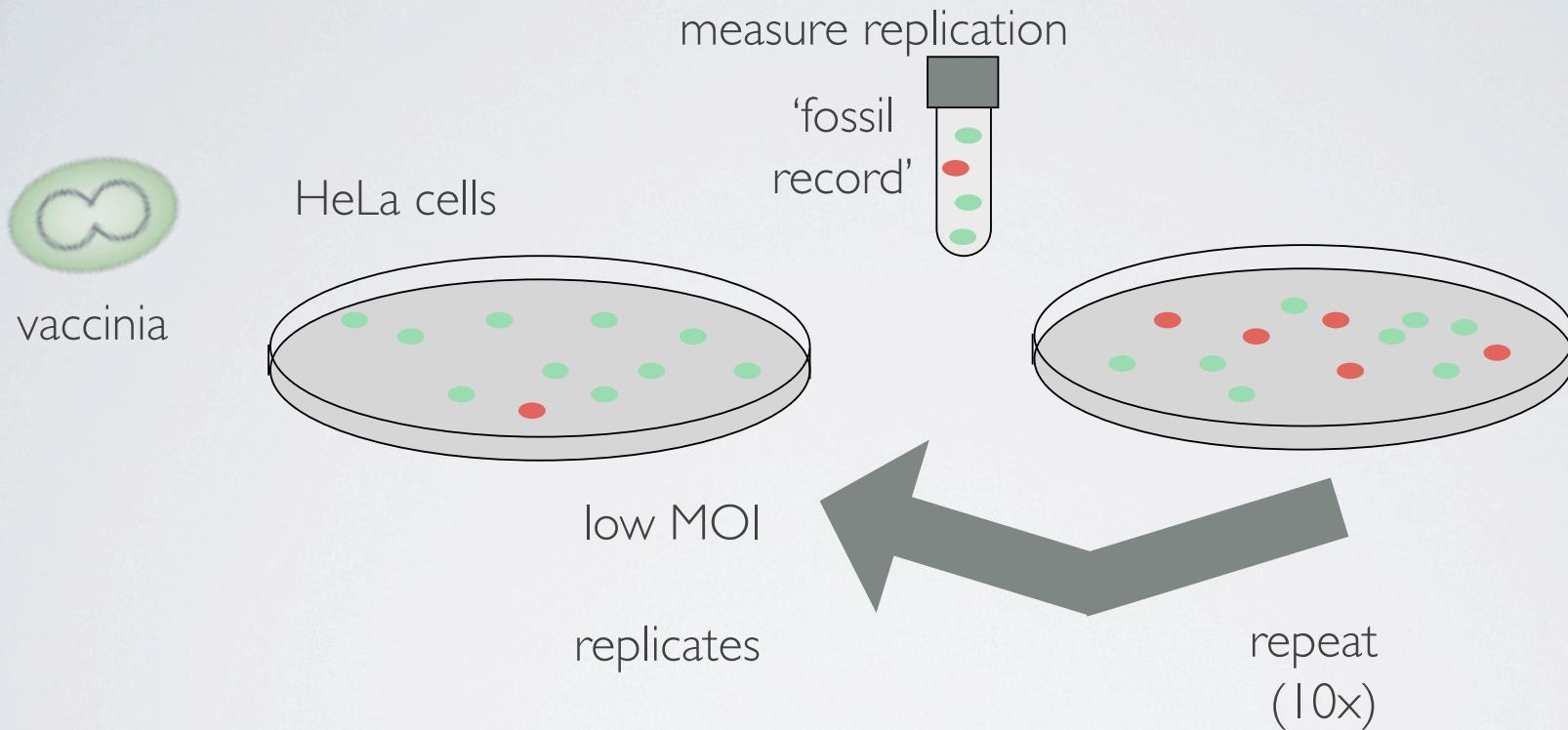
dN/dS

EXPERIMENTAL EVOLUTION



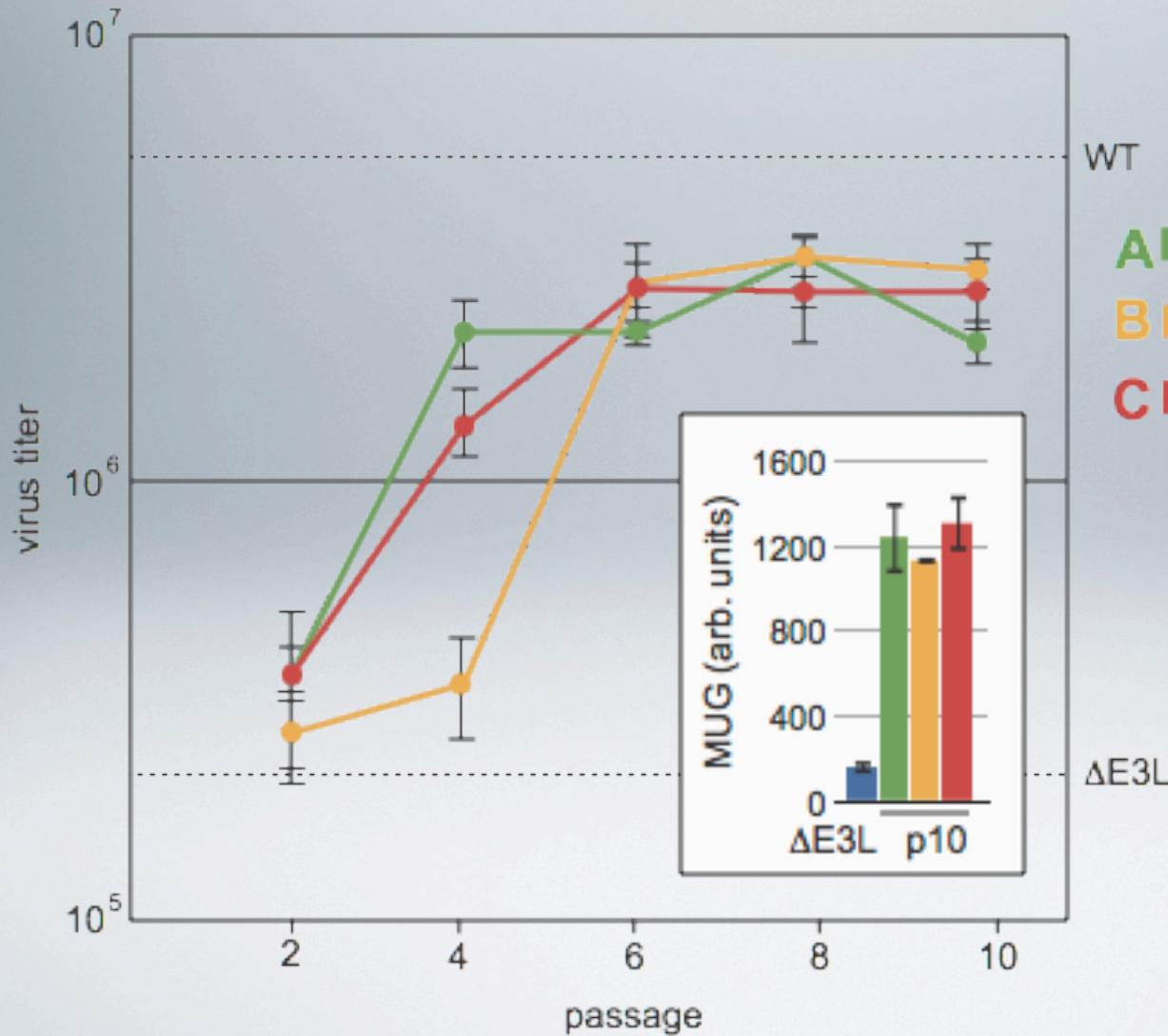
adapted from
Langland and Jacobs, Virology, 2002

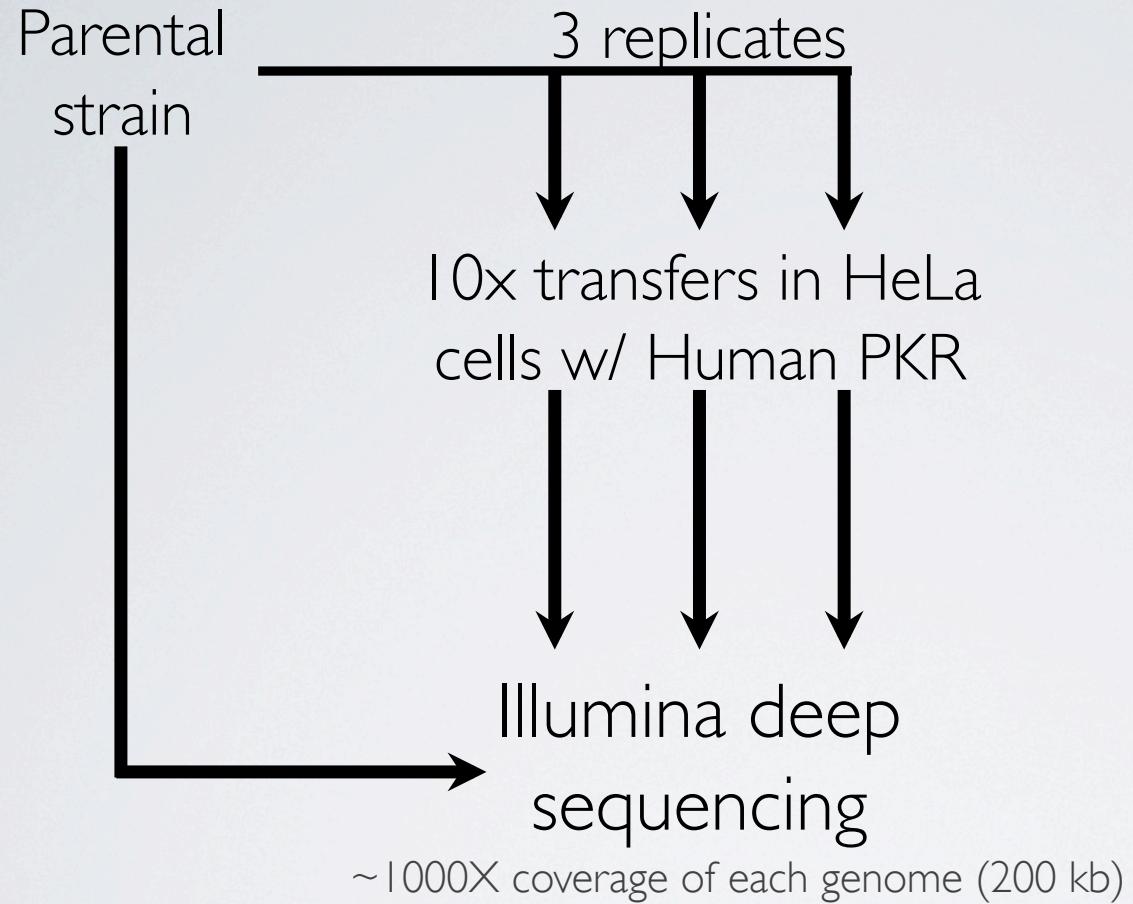
experimental evolution



Geballe Lab

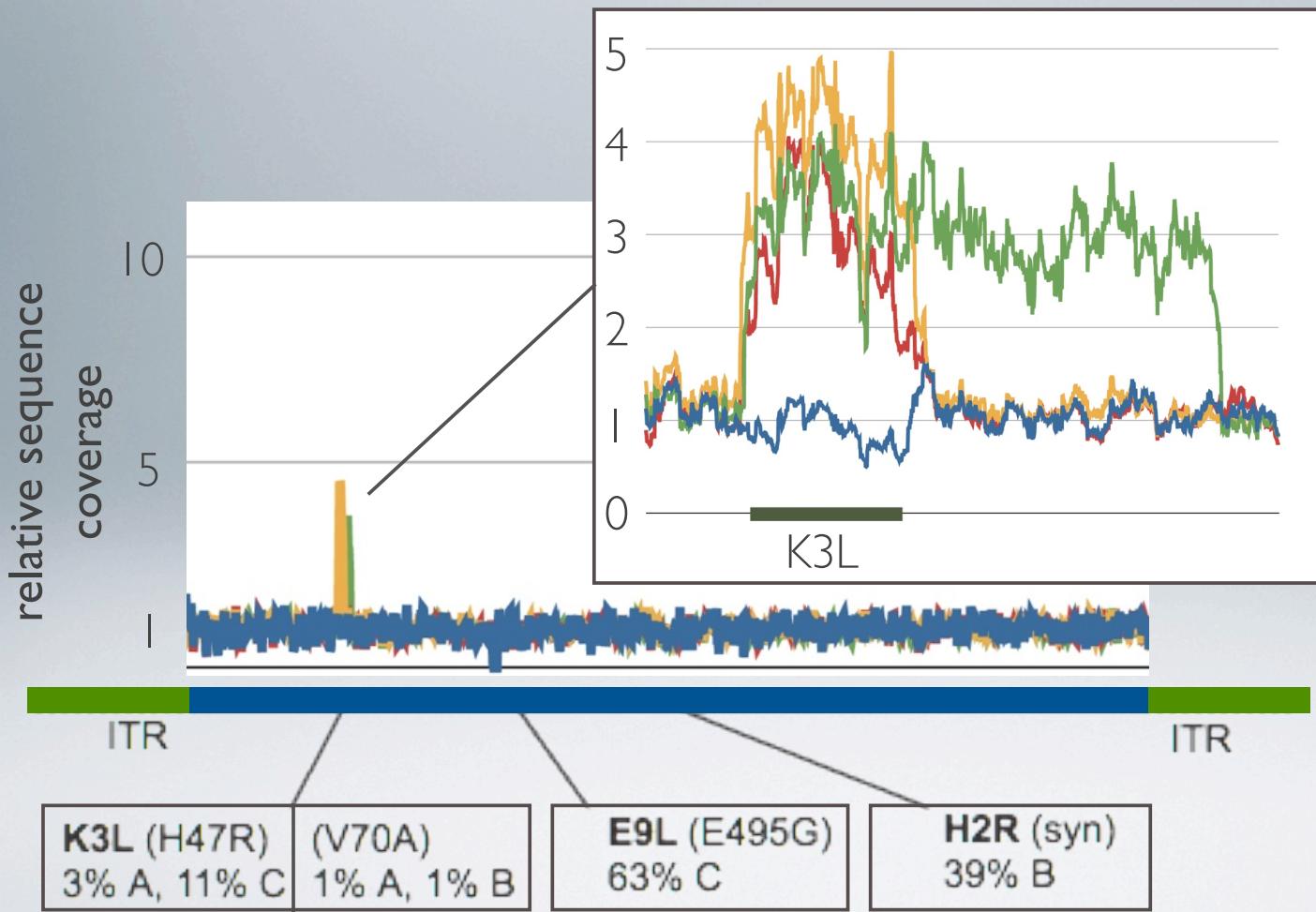
evolution of vaccinia



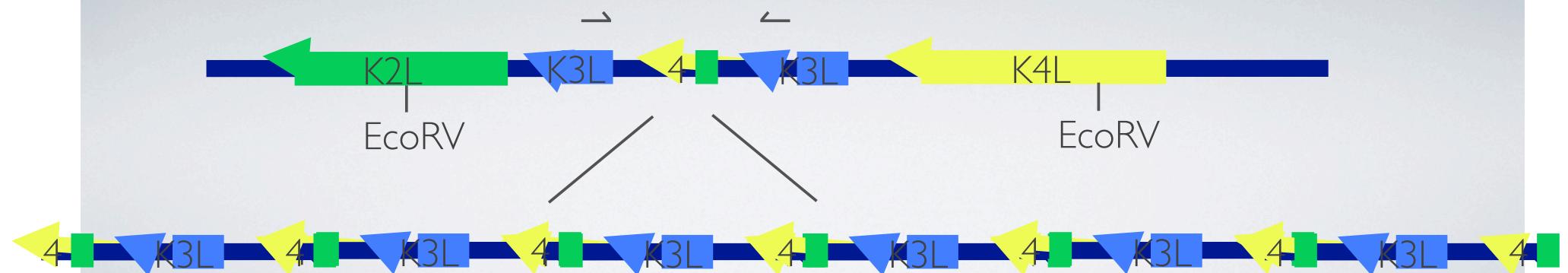
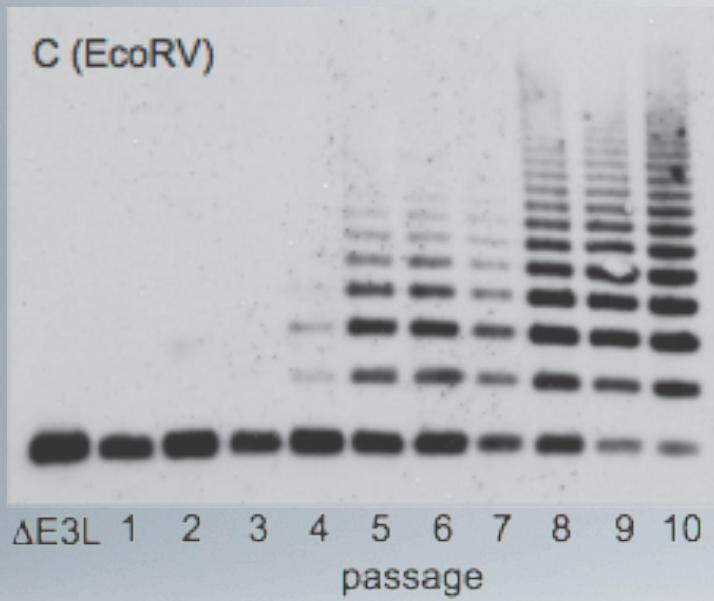


Shendure Lab

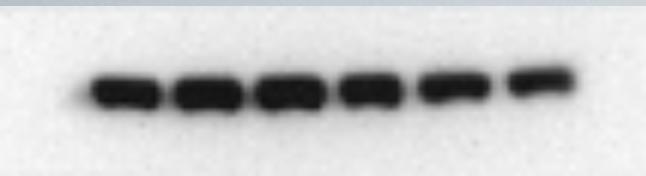
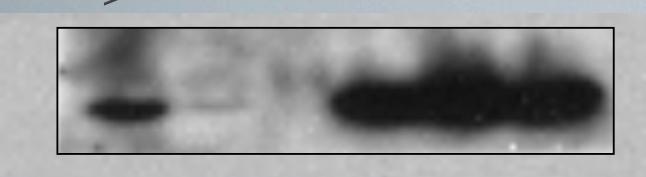
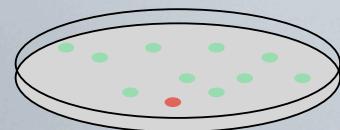
evolution of vaccinia



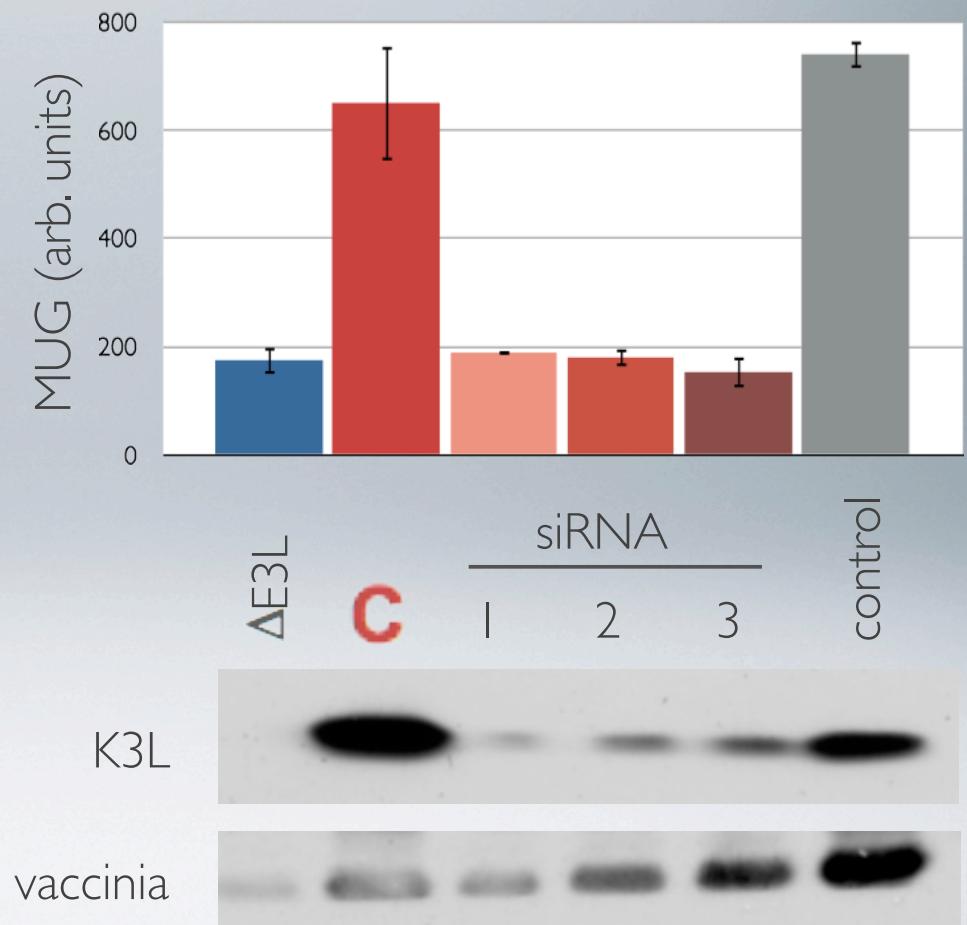
evolution of CNV



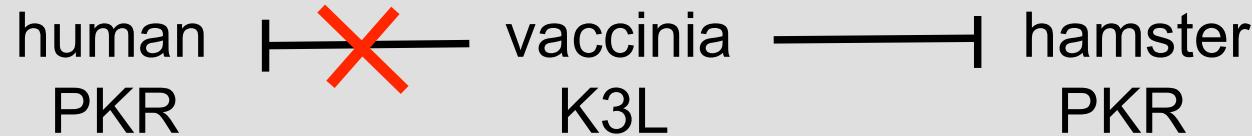
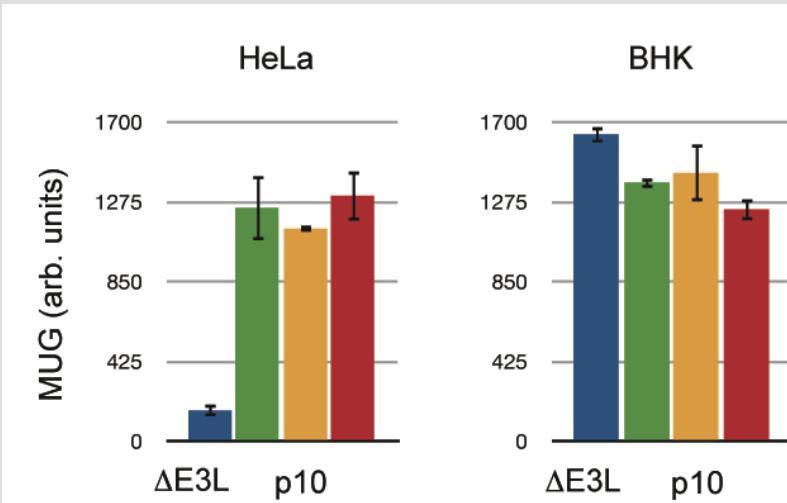
adaptive K3L duplications

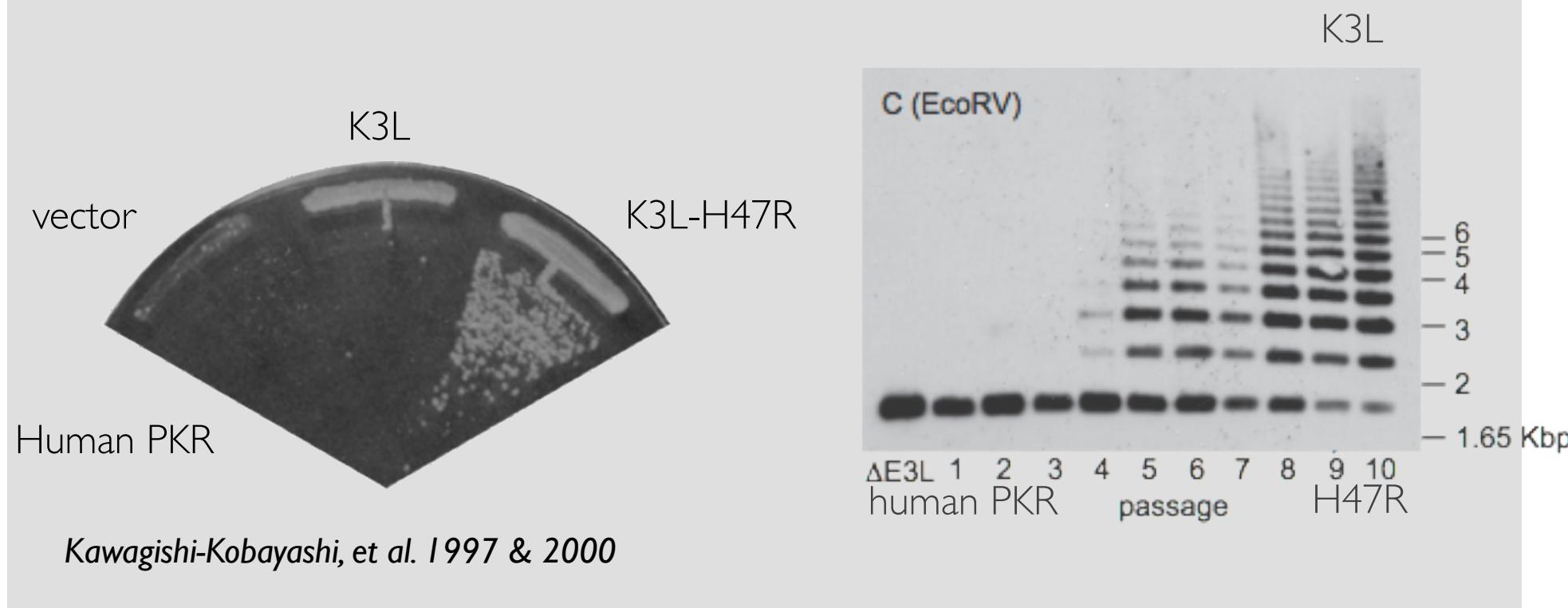
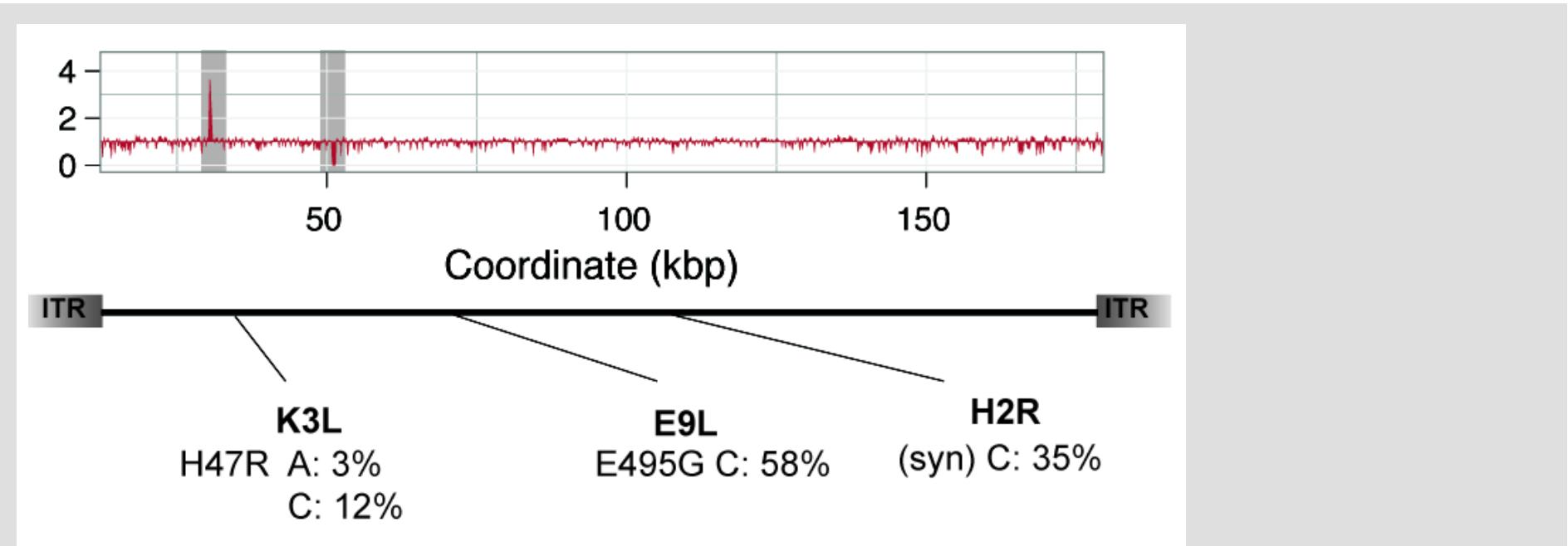


K3L
siRNA

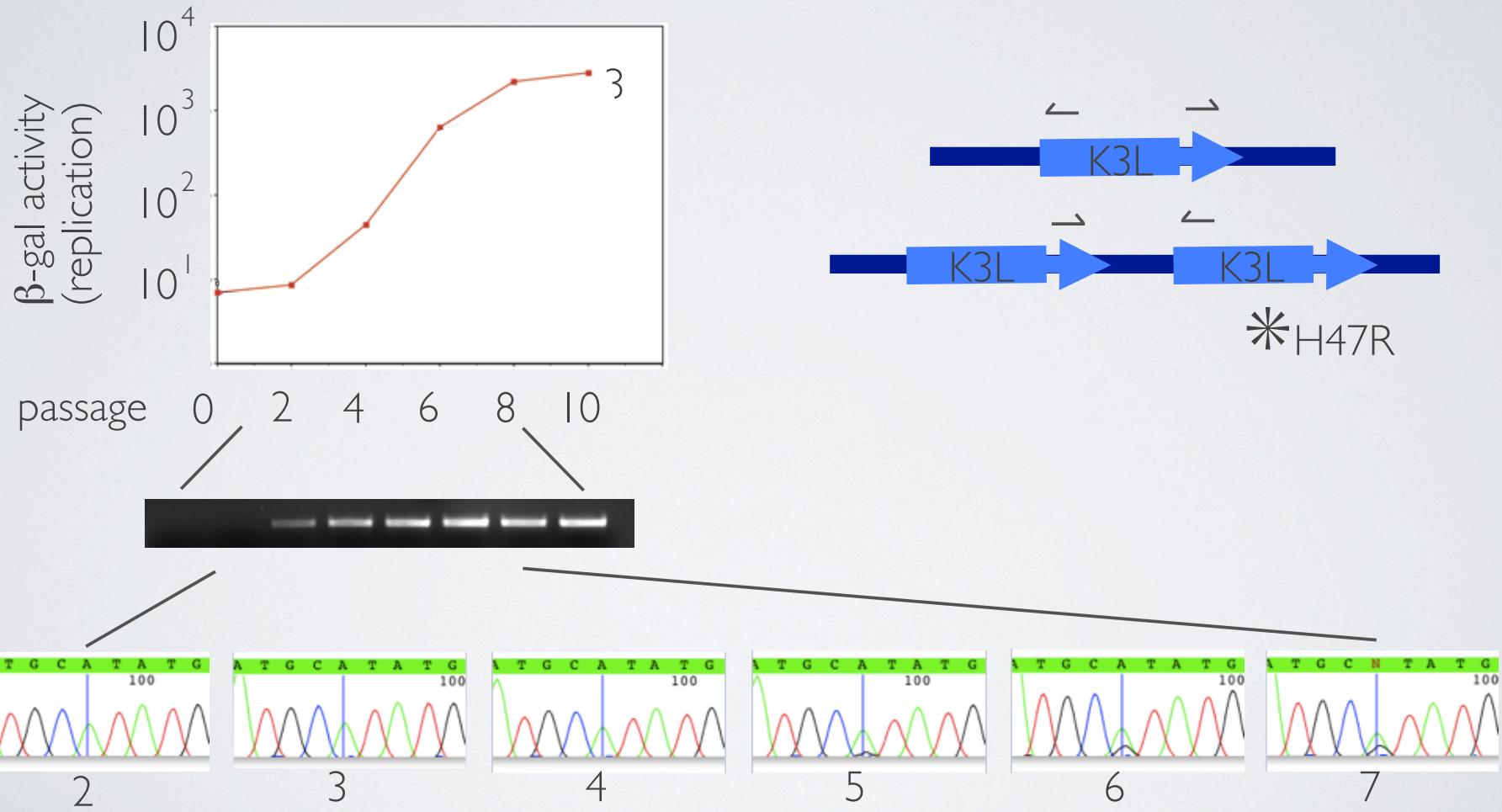


A trade-off associated with K3L gene expansion

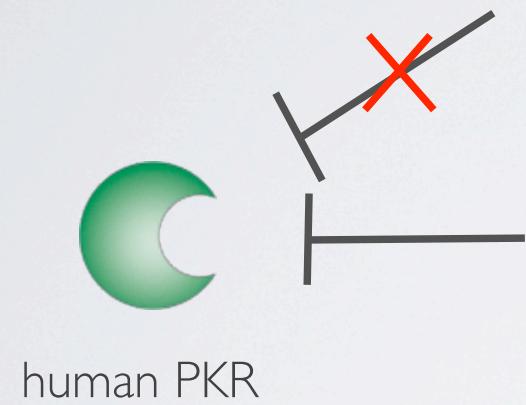




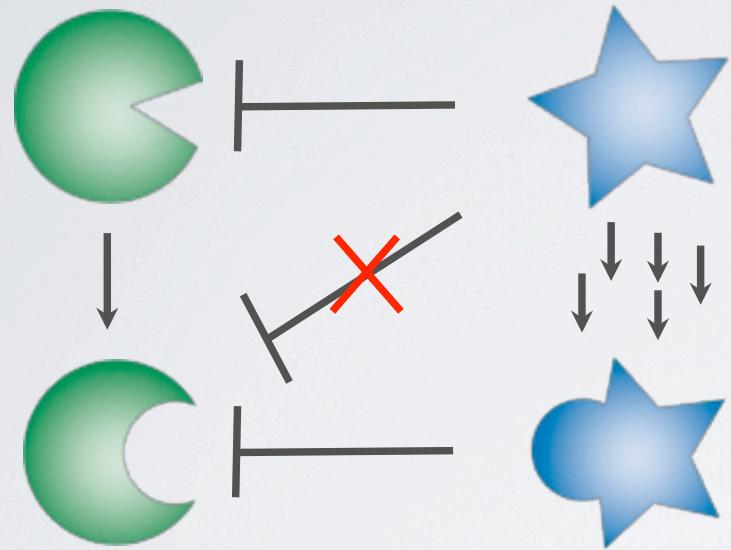
adaptation via duplication



Does the Red Queen always play the accordion?



Antiviral protein



Viral protein



Nels Elde

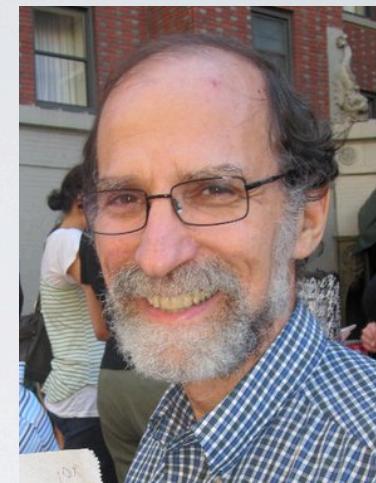
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