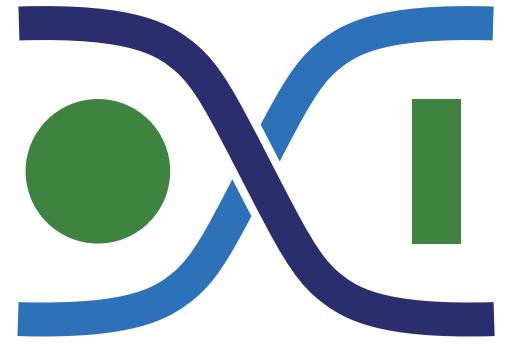




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Genomics &
Computational
Biology

The Evolution of KoRV-A and Its Transcriptional Silencing in Wild Koalas

Tianxiong Yu
Instructor
Umass Chan Medical School
CSH Retroviruses
May, 2025

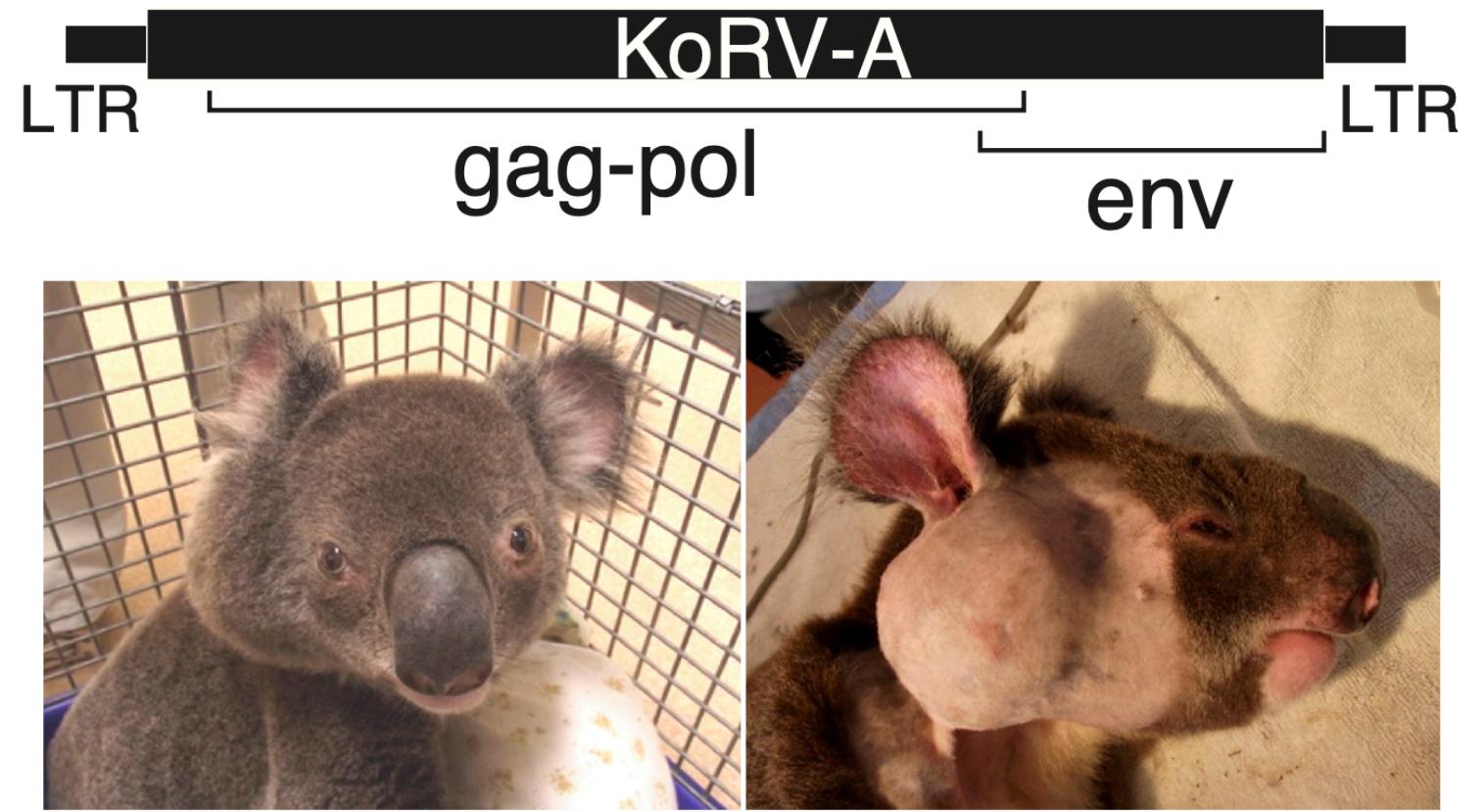


Why Koalas and Koala Retrovirus (KoRV)?



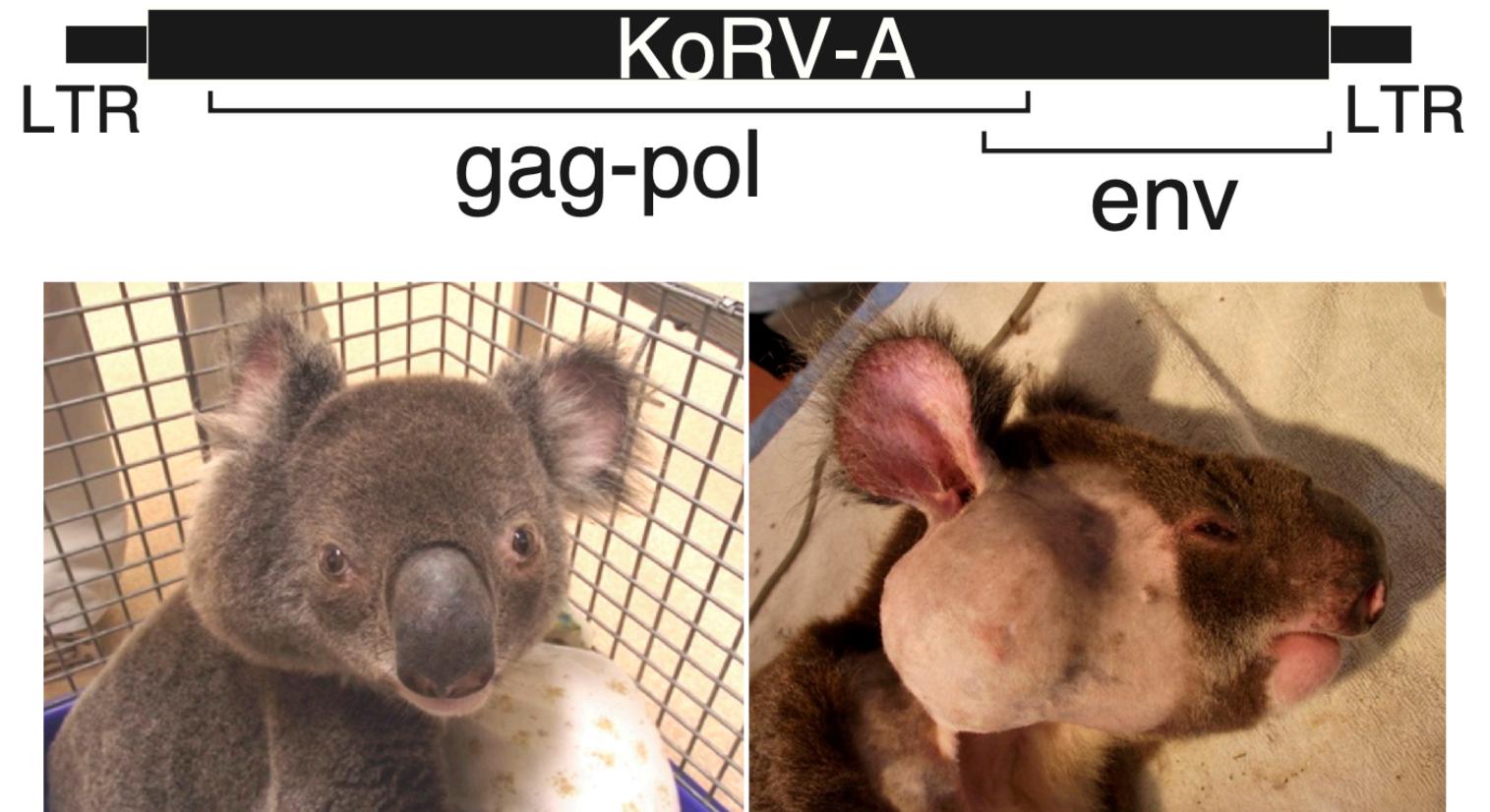
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- KoRV is the agent of koala immune deficiency syndrome (KIDS) and associates with leukemia and cancers.



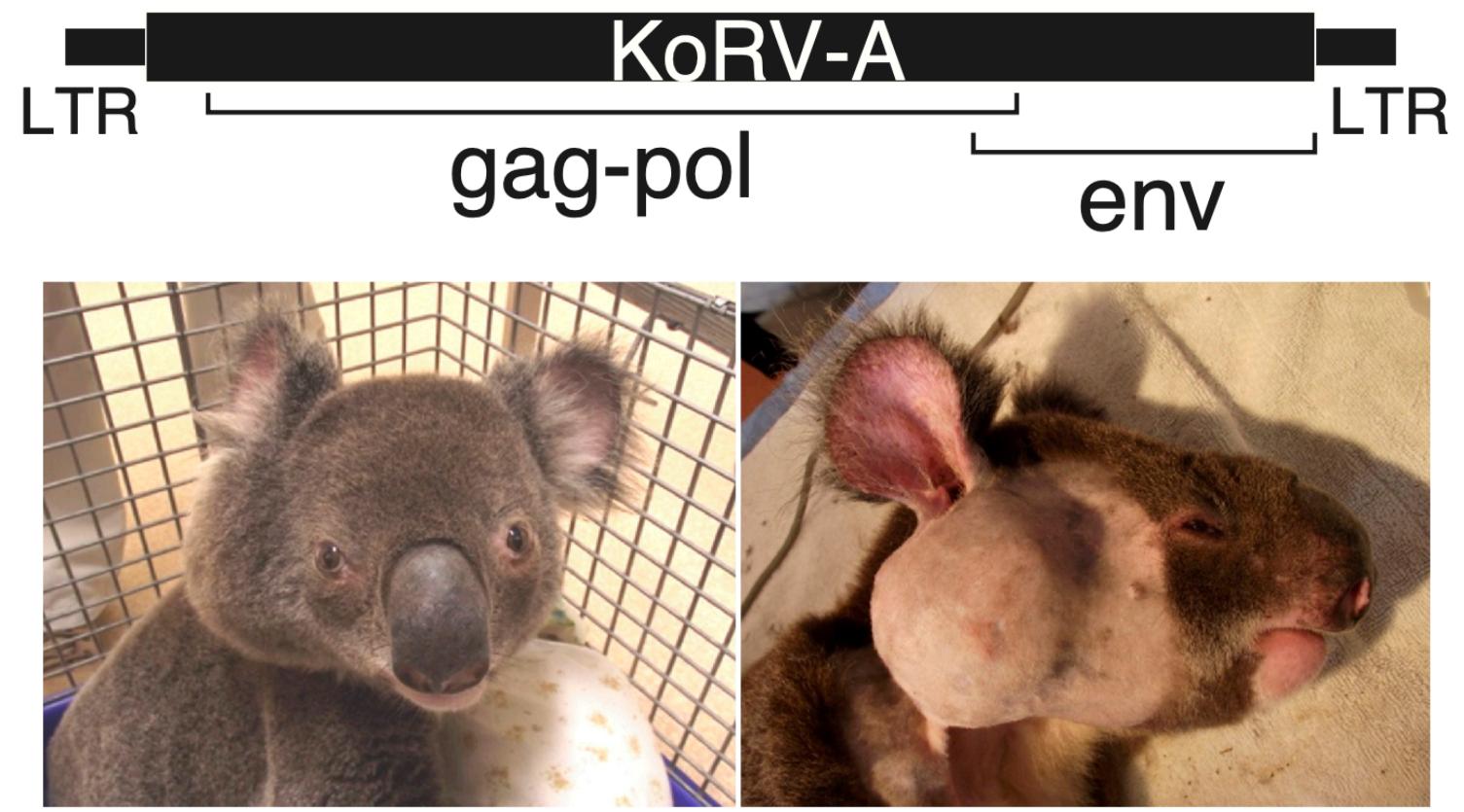
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- *Save koalas? Yes, but not our initial purpose.*



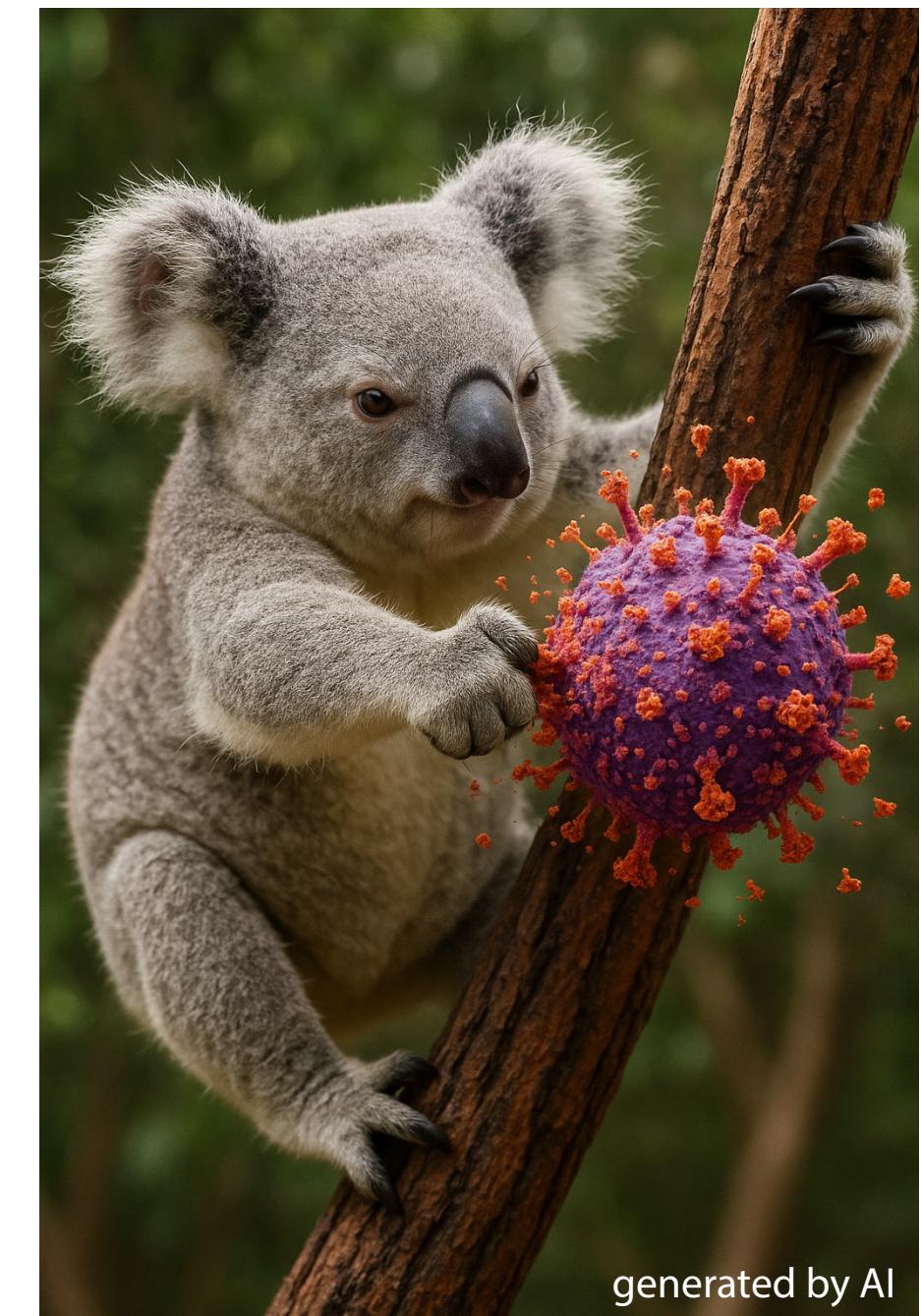
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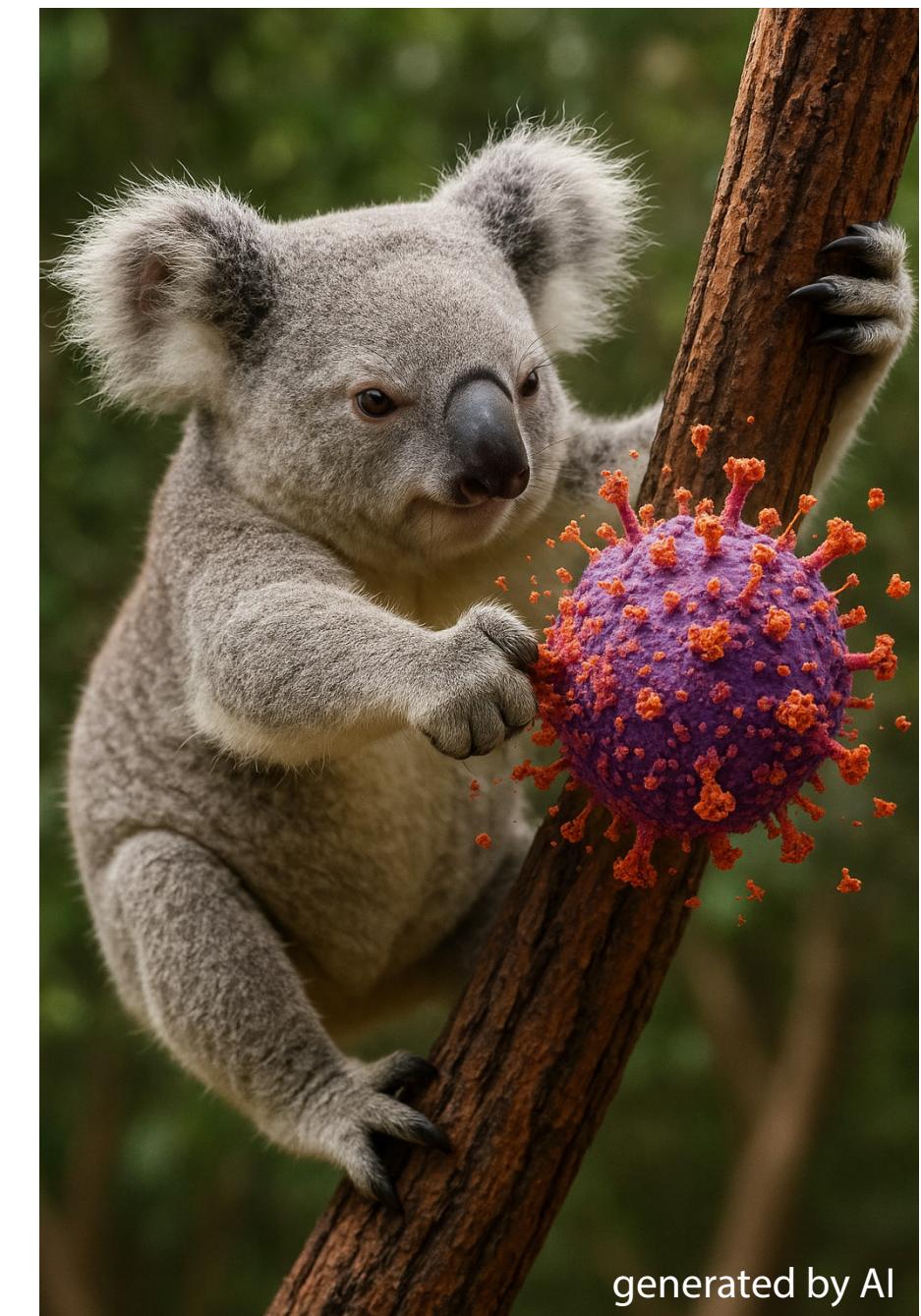
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 - *How koalas fight back!*



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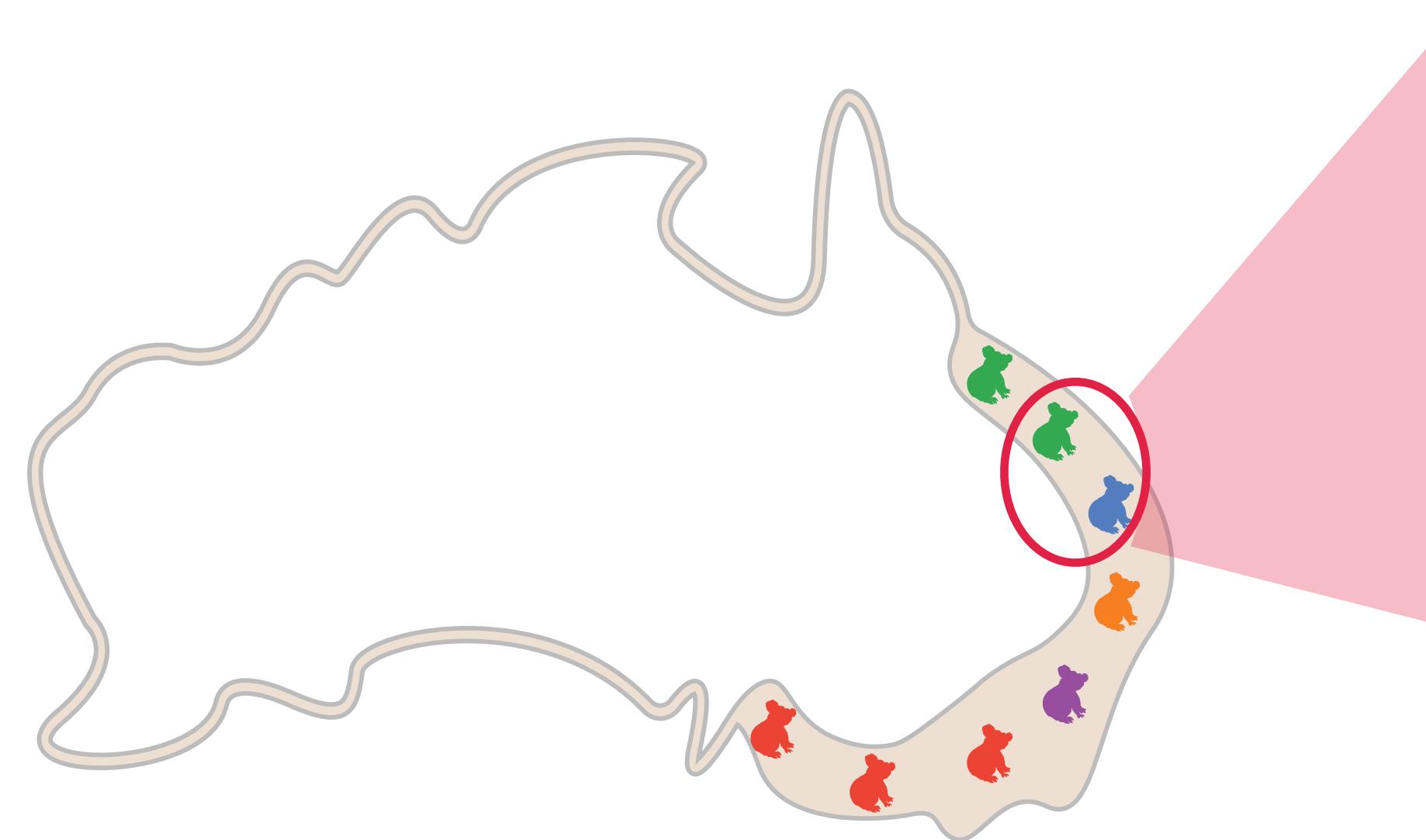
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 - *How koalas fight back!*
 - Studying the *history*: how did human and other species control the spreading of endogenous retroviruses?
 - Prepare for the *future*: how will our genome respond / what shall we do, upon new retroviral invasion?



generated by AI

Deep sequencing of koala tissues



Australia

Brisbane River

Sunshine Coast
2 males, 1 female

Currumbin
4 males, 1 female



RNA-seq, small RNA-seq,
and short- and long- read DNA-seq
in koala testis, liver, and brain



Milky Abajorga

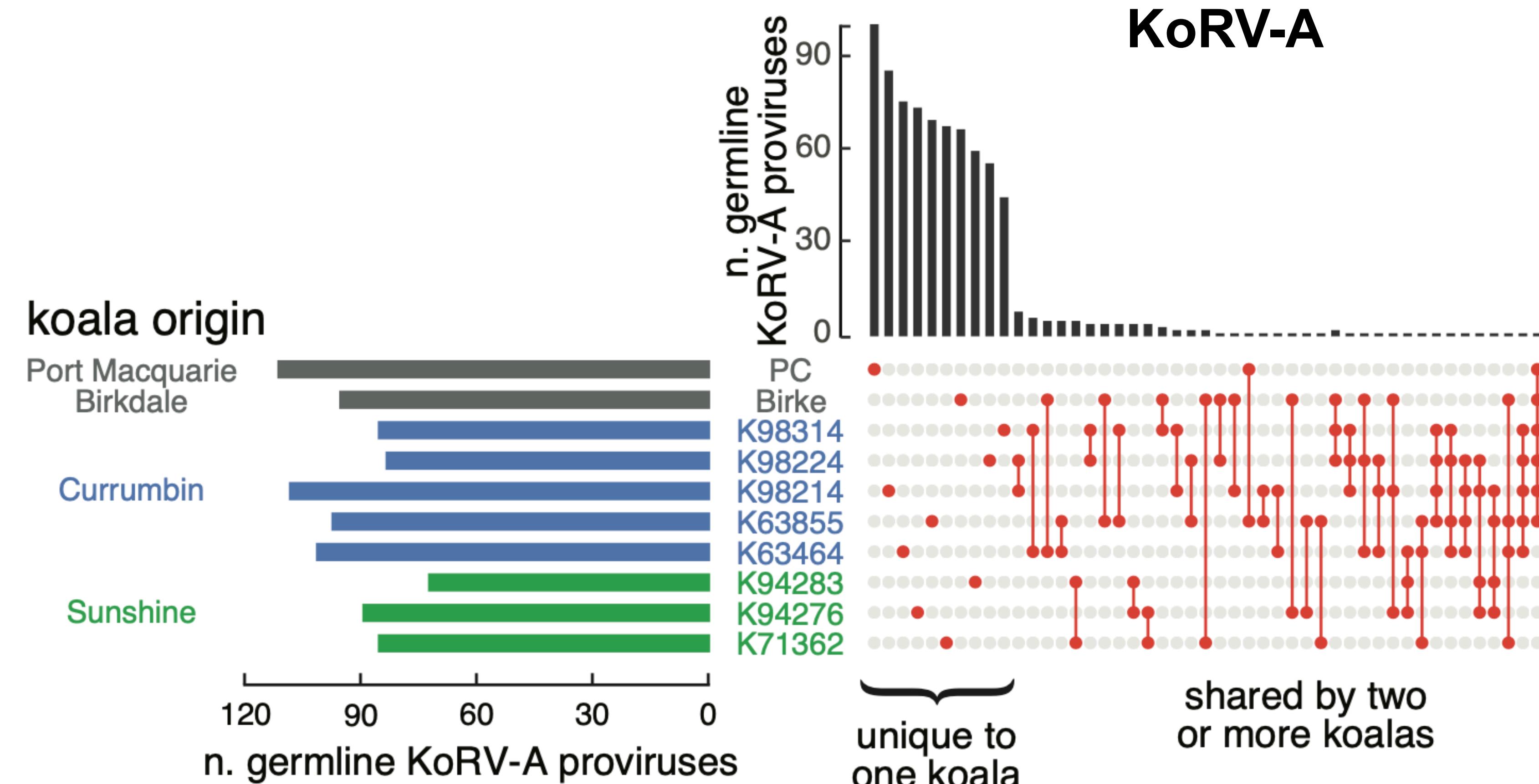


Samantha Ho
Birgit Koppetsch



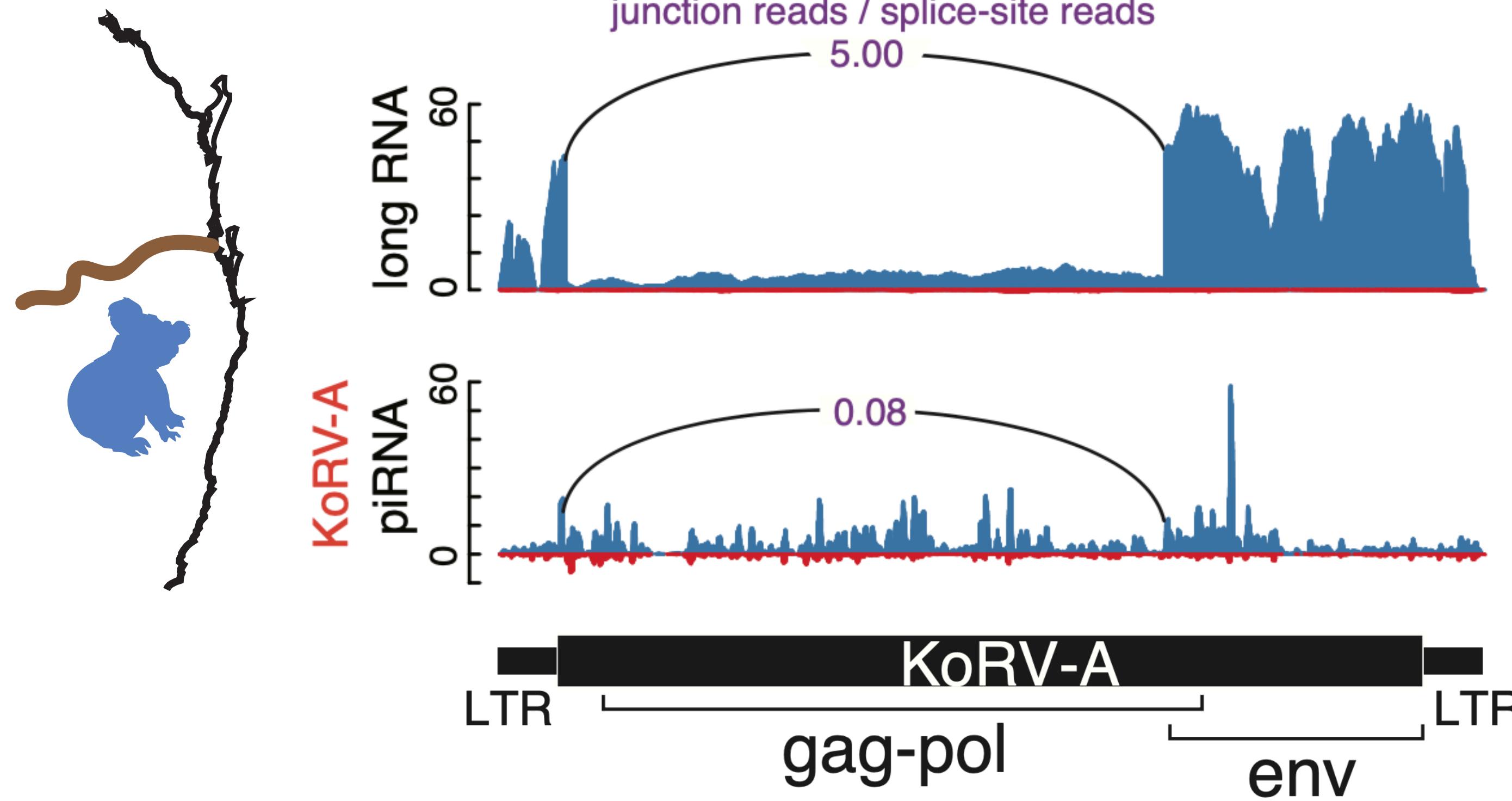
Michaela Blyton

KoRV-A are actively replicating in the koala genome

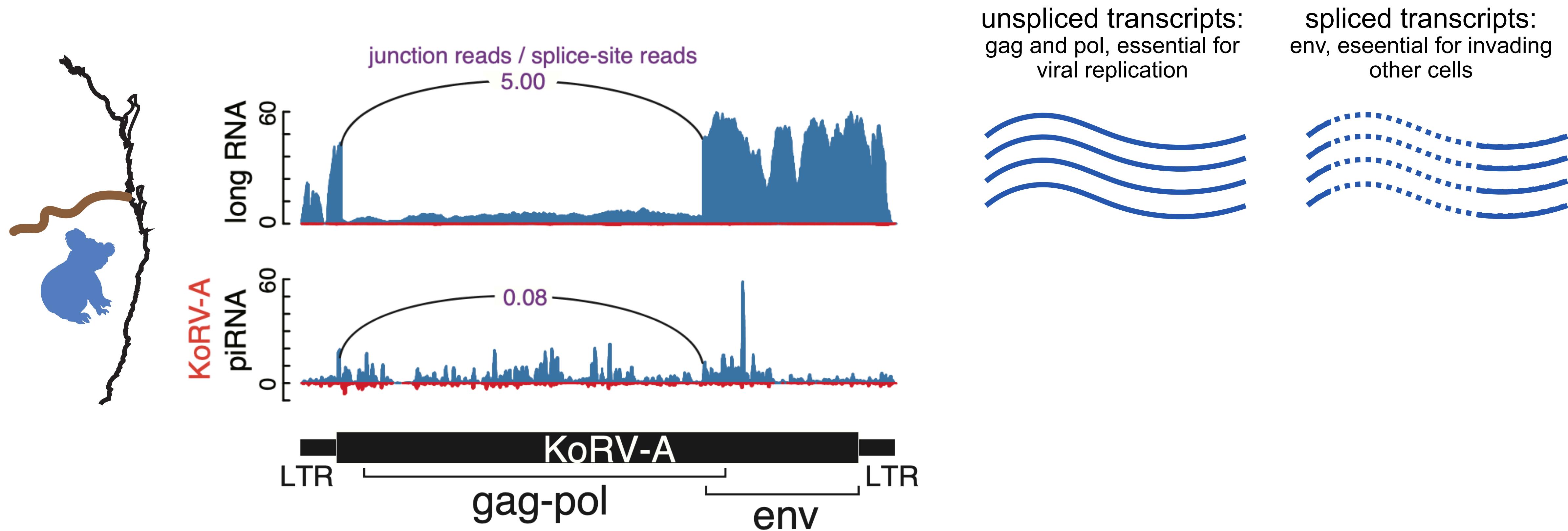


- Each koala have ~70–110 KoRV-A proviruses.
- Not a single KoRV-A provirus is share in all koalas.

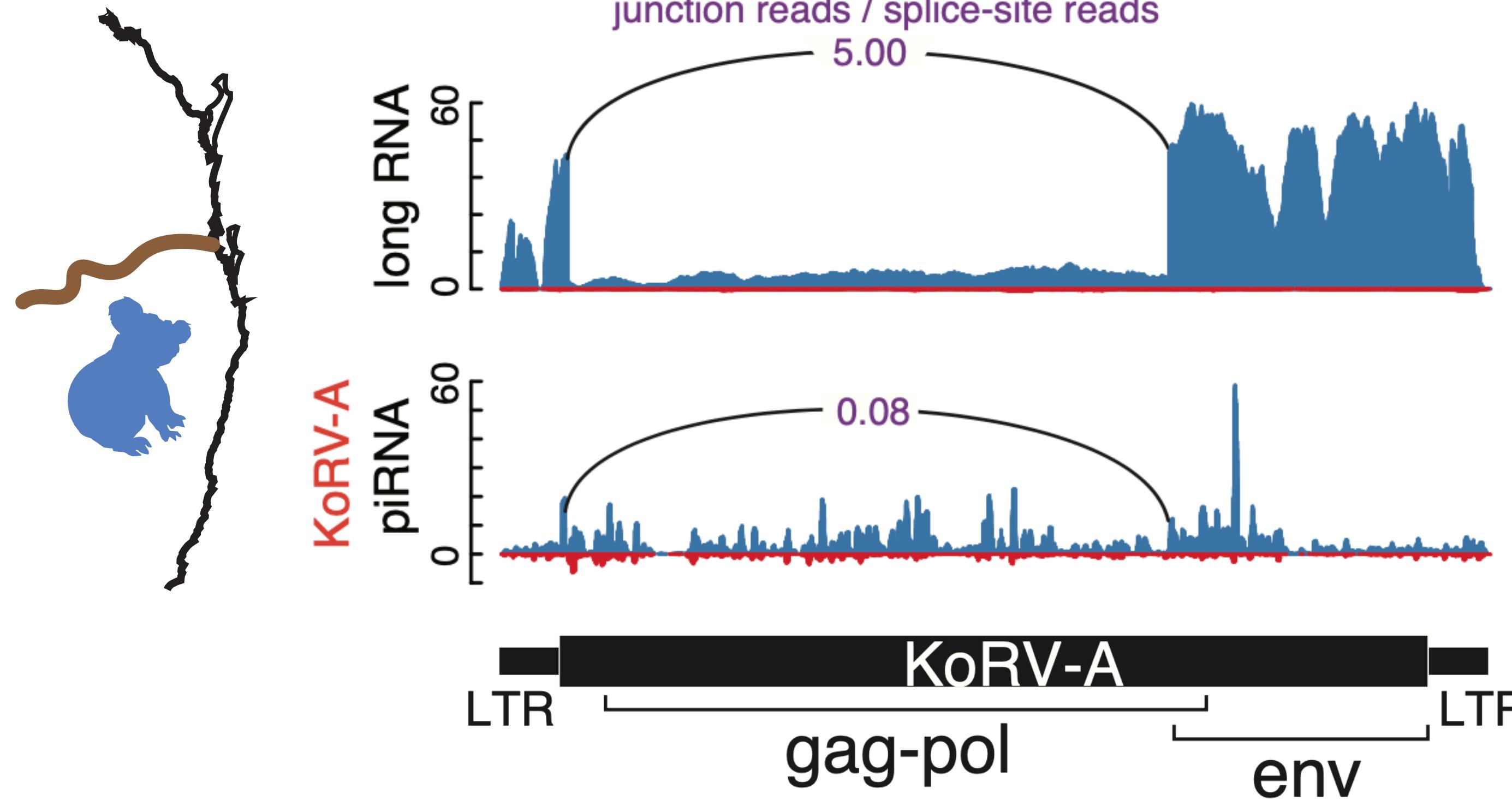
The piRNA pathway cleaves unspliced KoRV-A transcripts



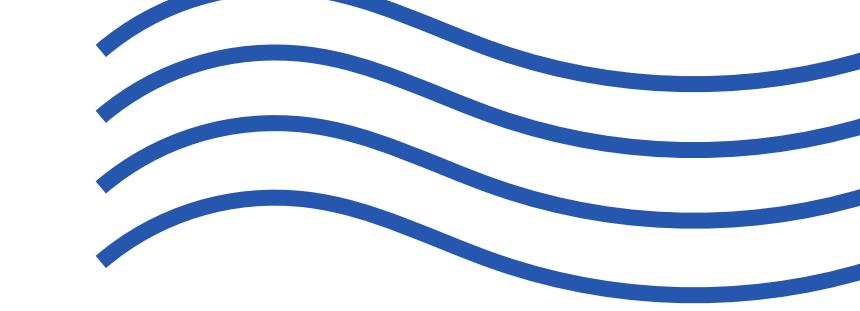
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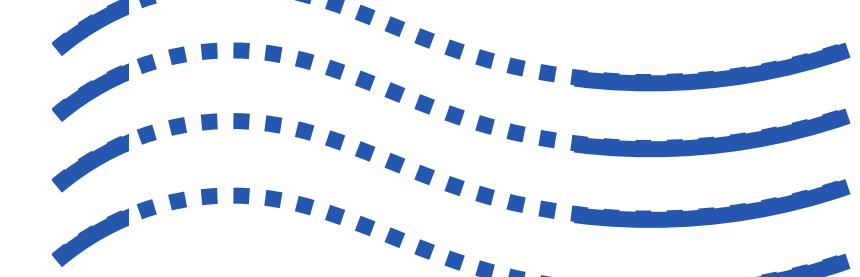
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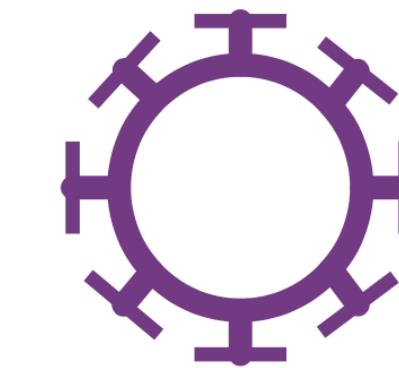
unspliced transcripts:
gag and pol, essential for
viral replication



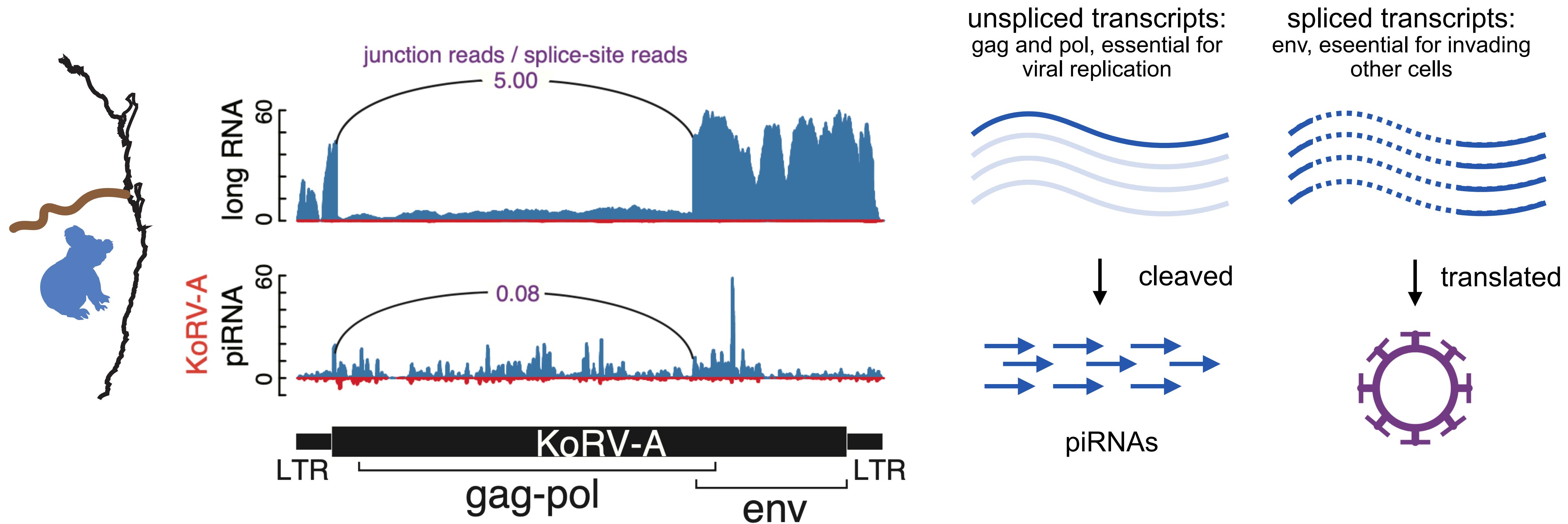
spliced transcripts:
env, essential for invading
other cells



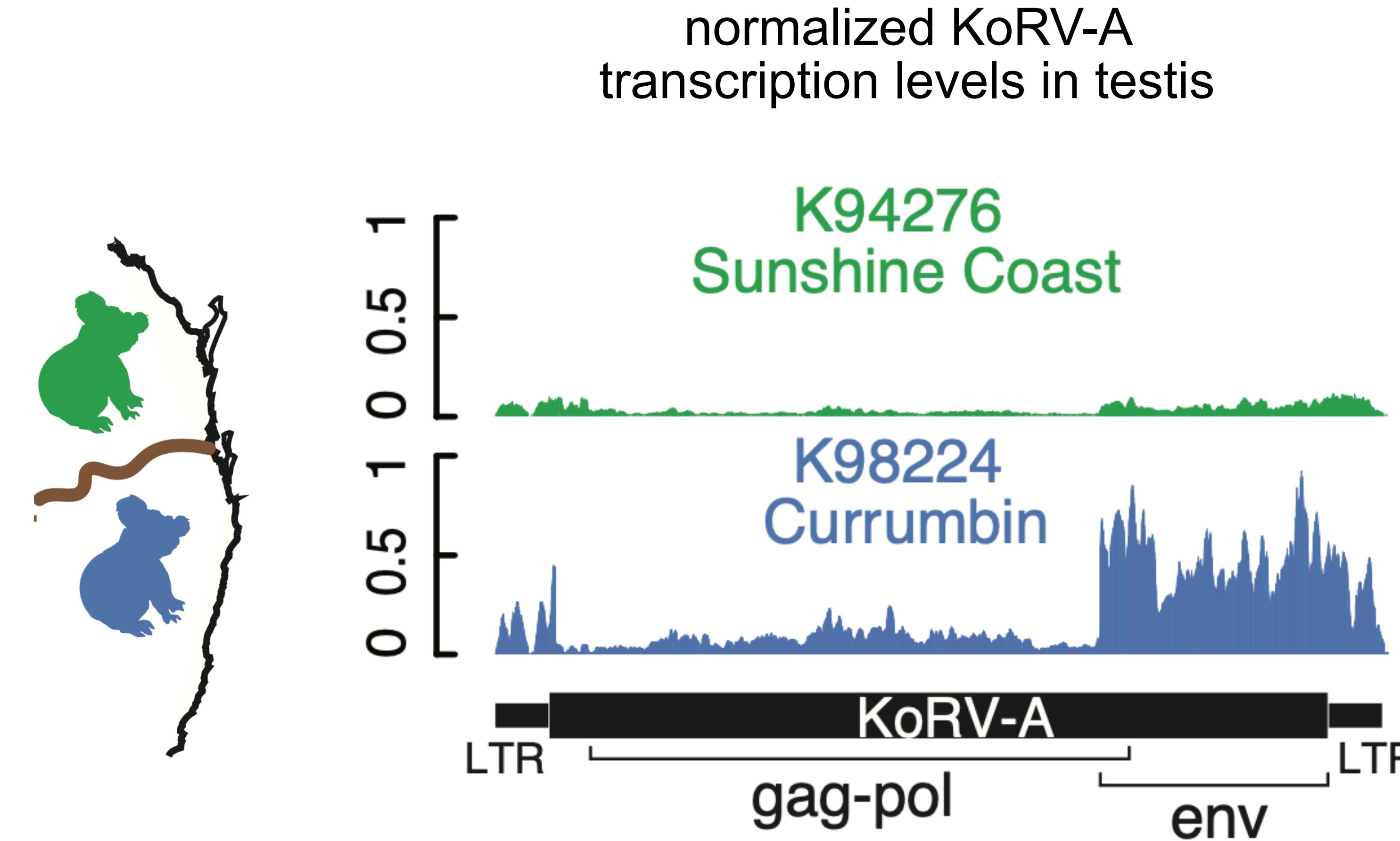
translated



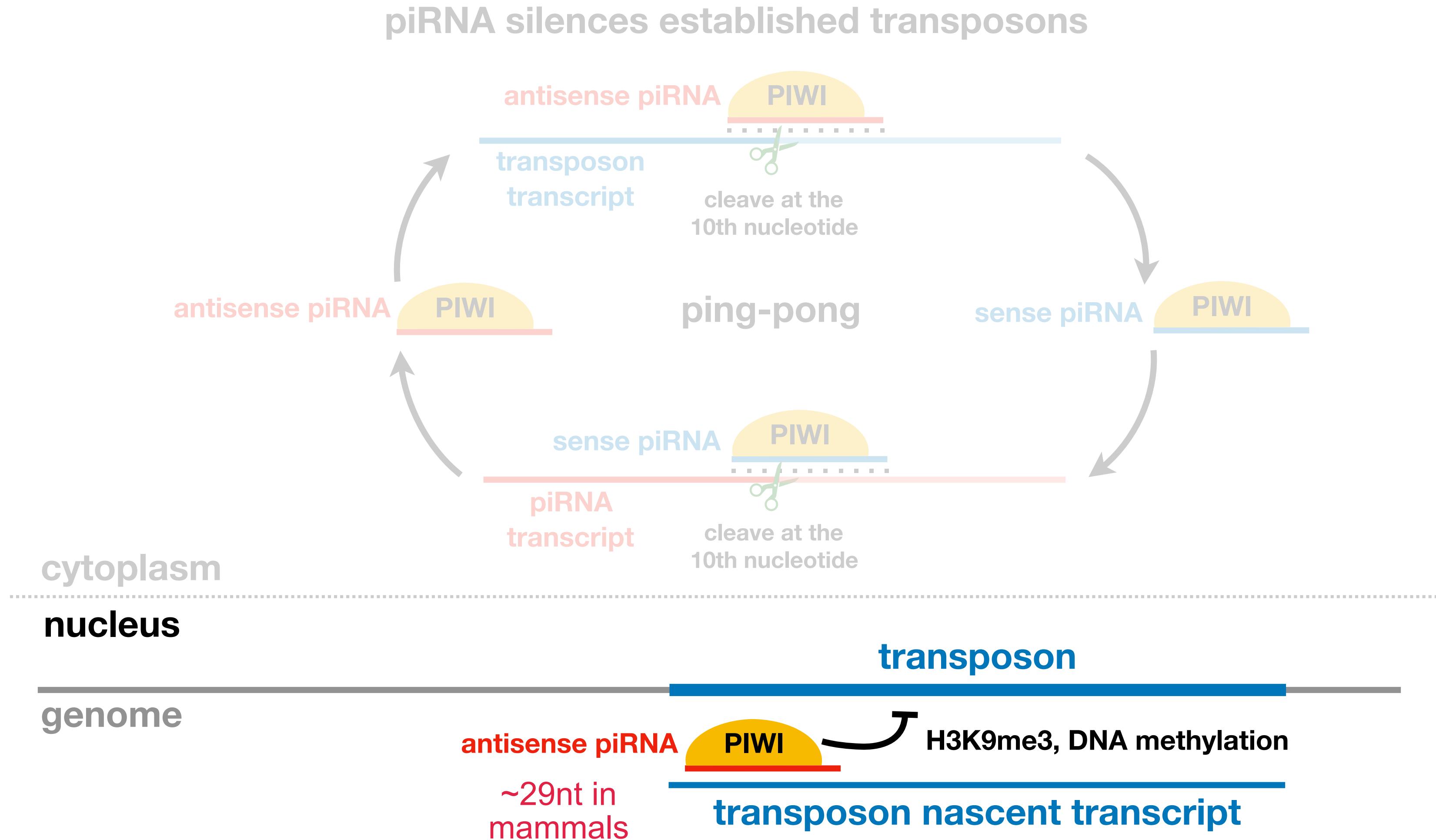
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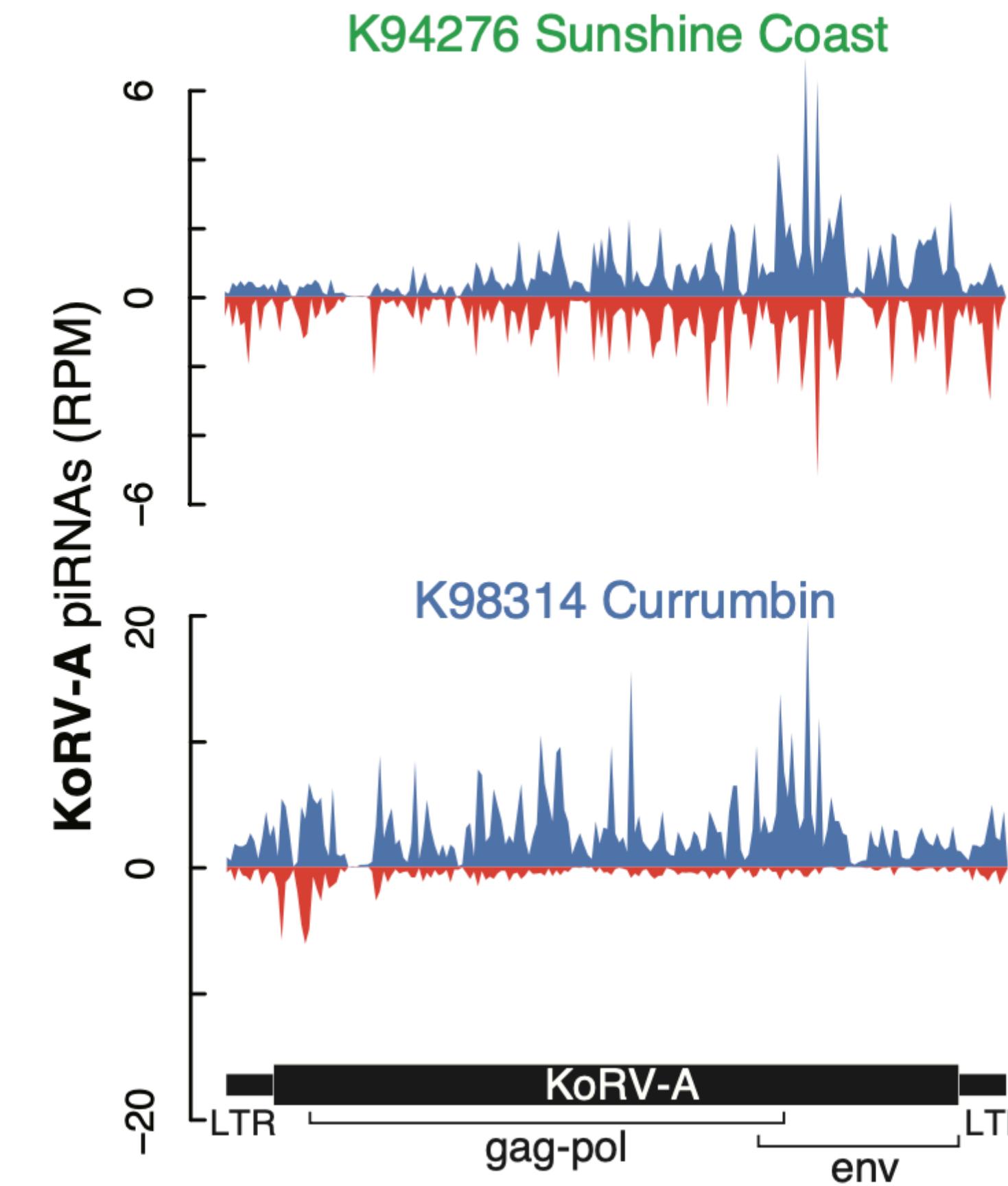
KoRV-A is silenced in the north



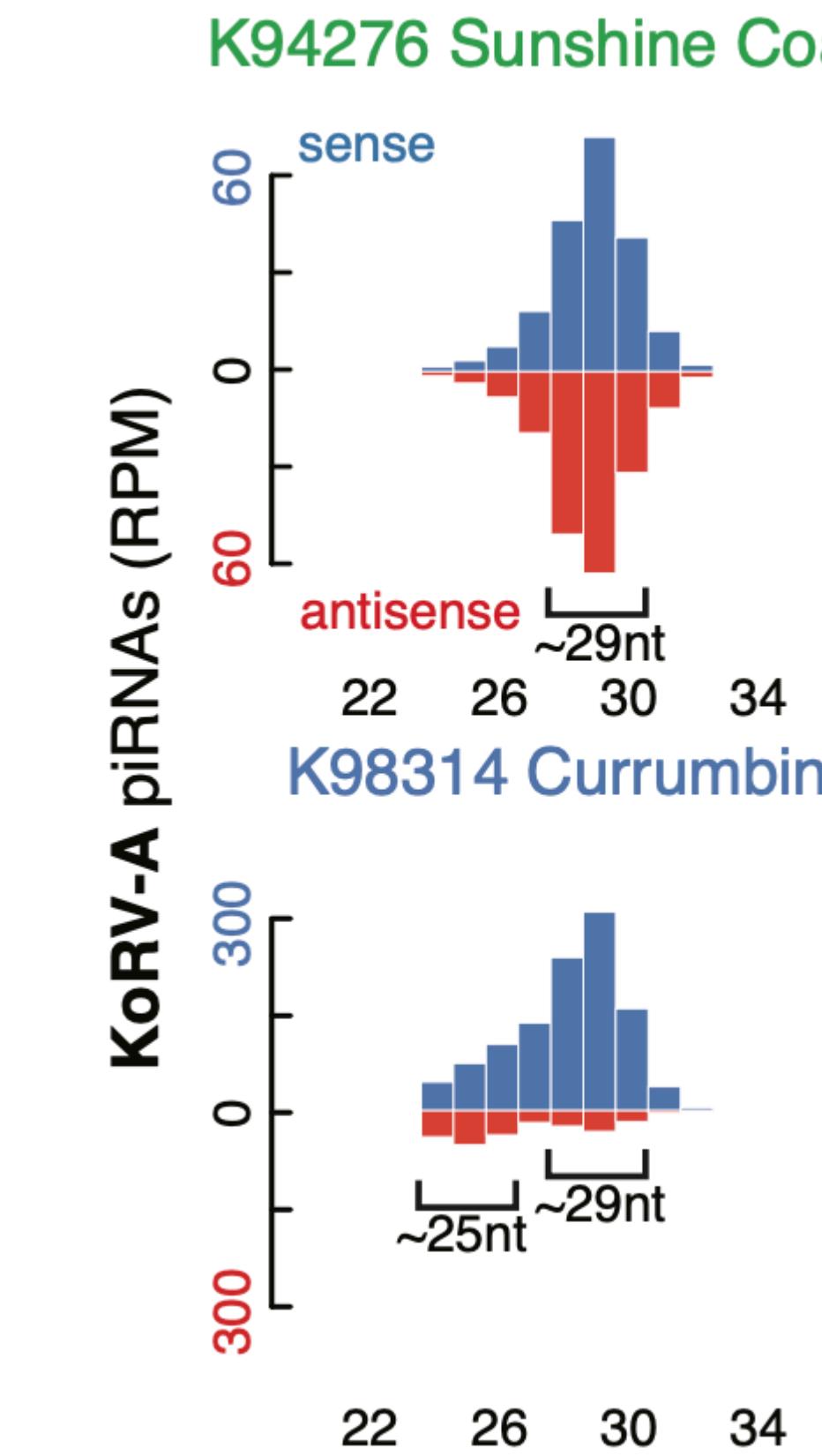
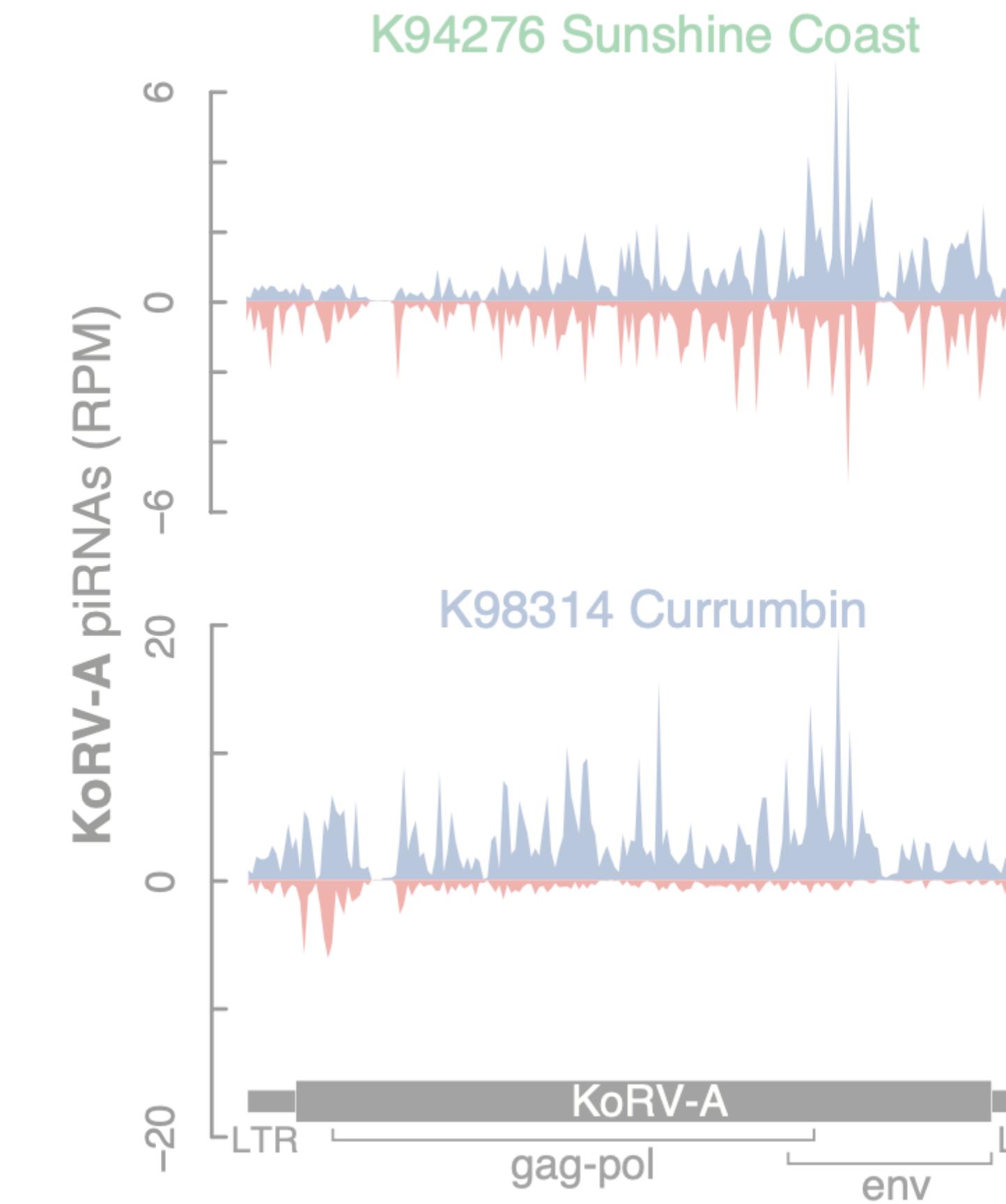
29-nt antisense piRNAs silences transposon transcriptionally



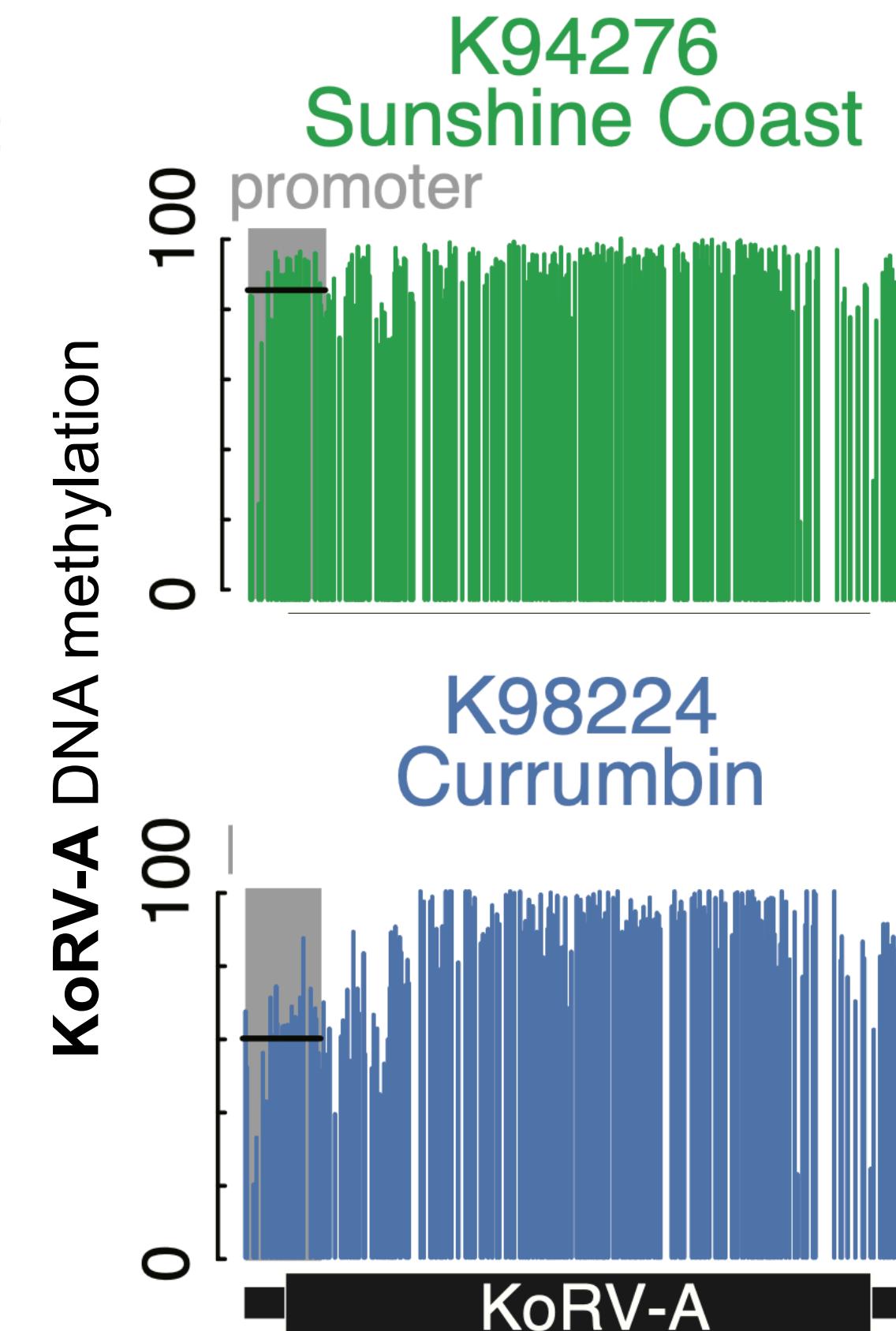
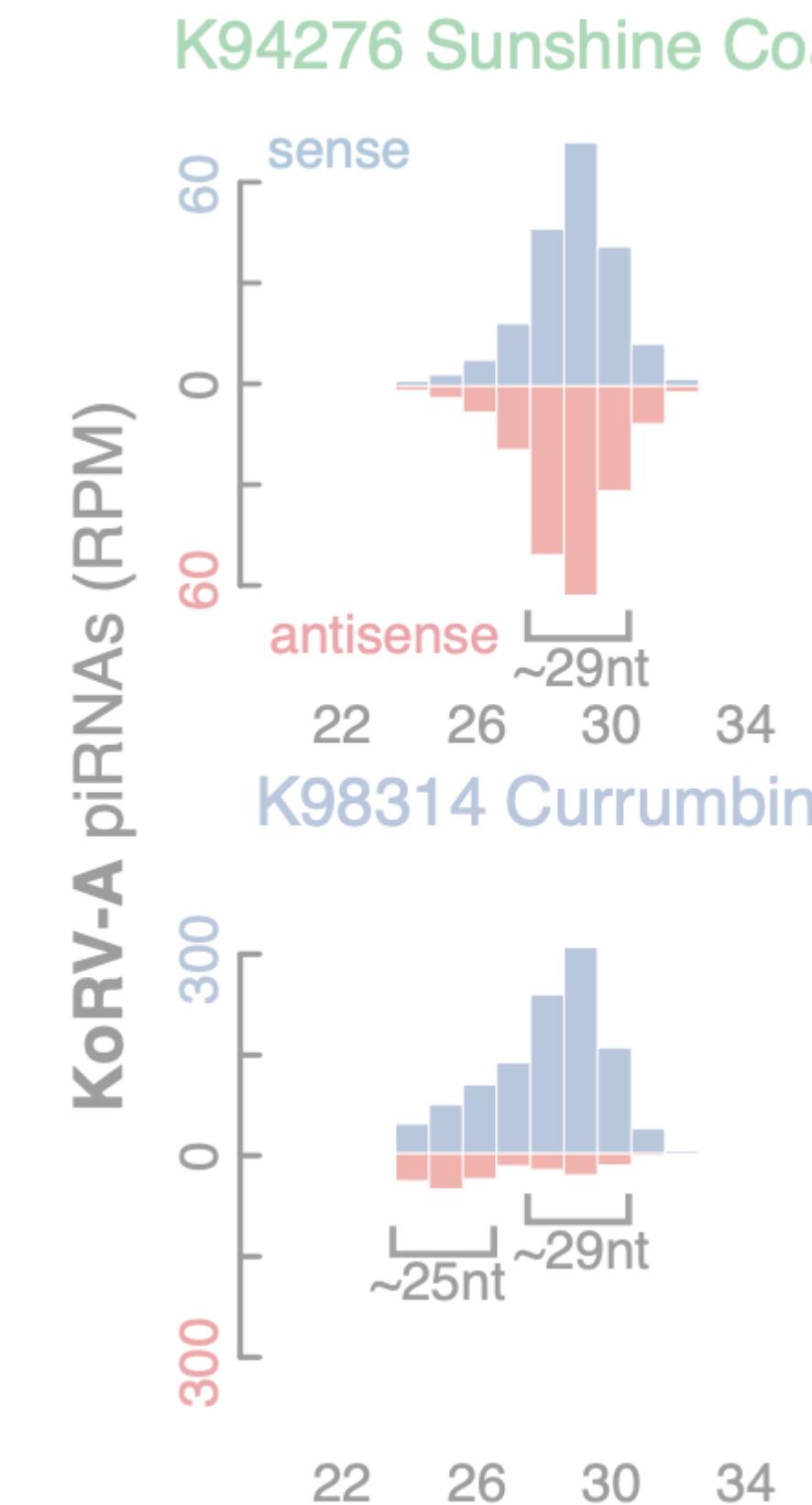
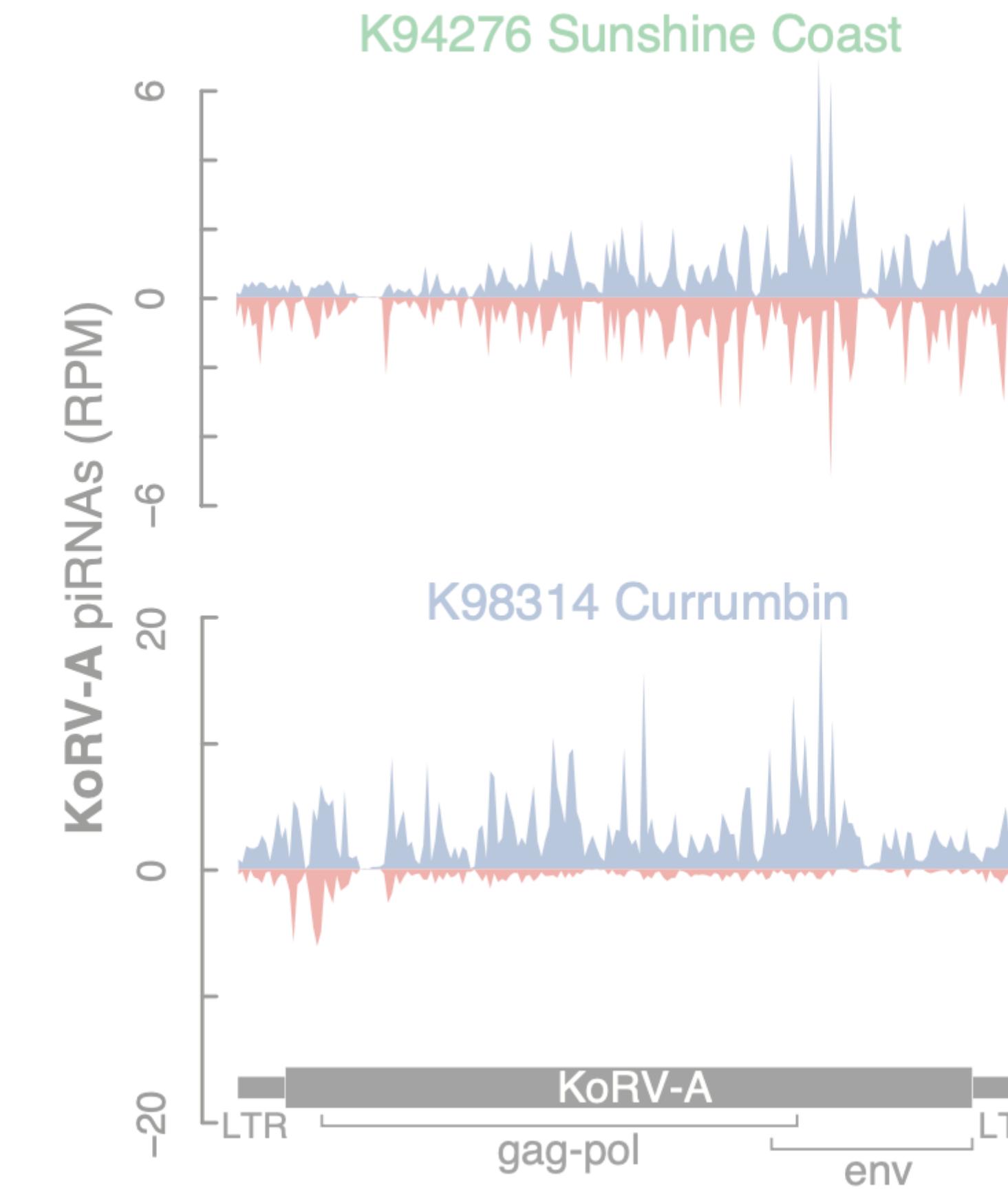
29-nt antisense piRNAs directs KoRV-A silencing in the north



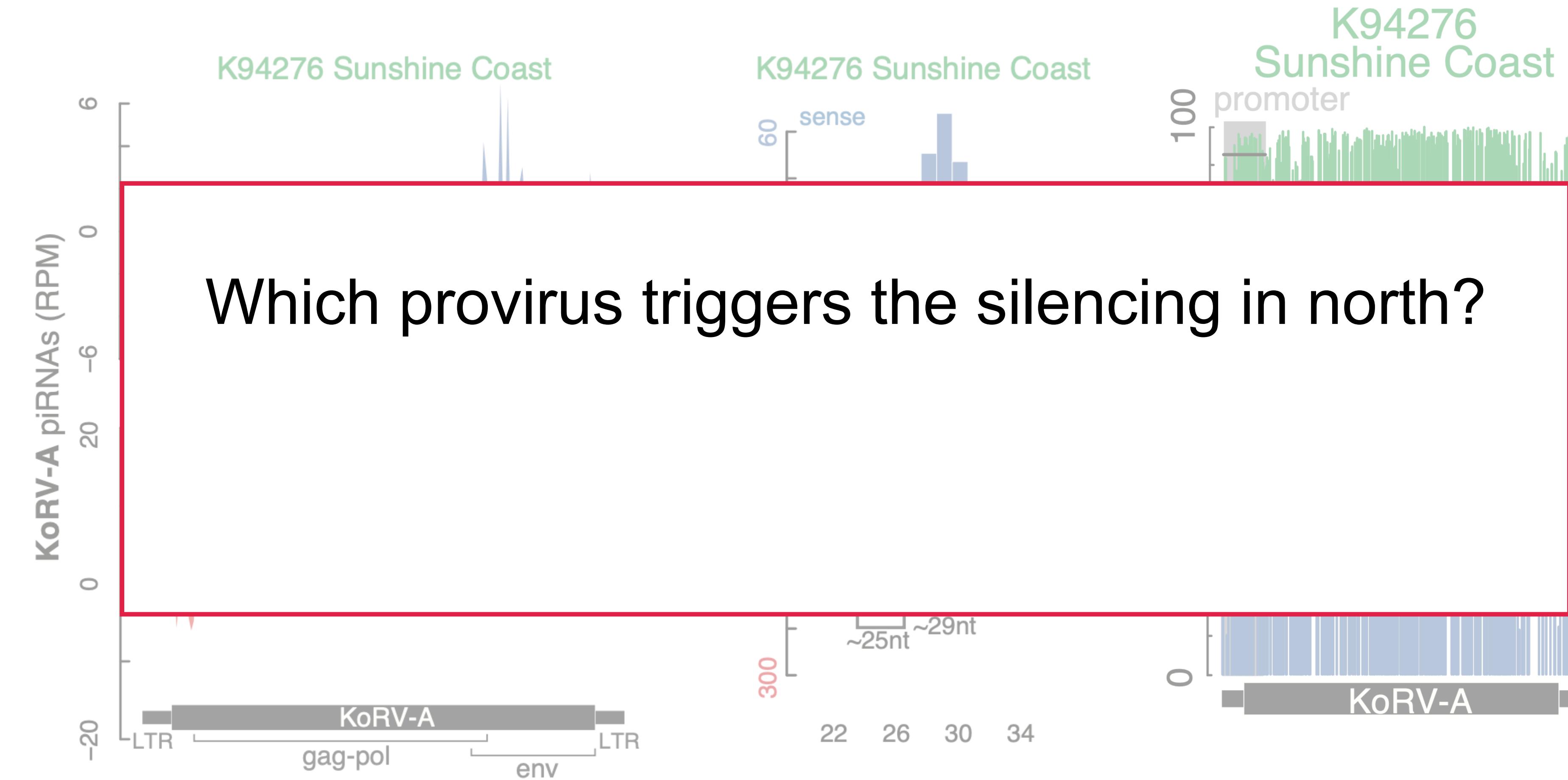
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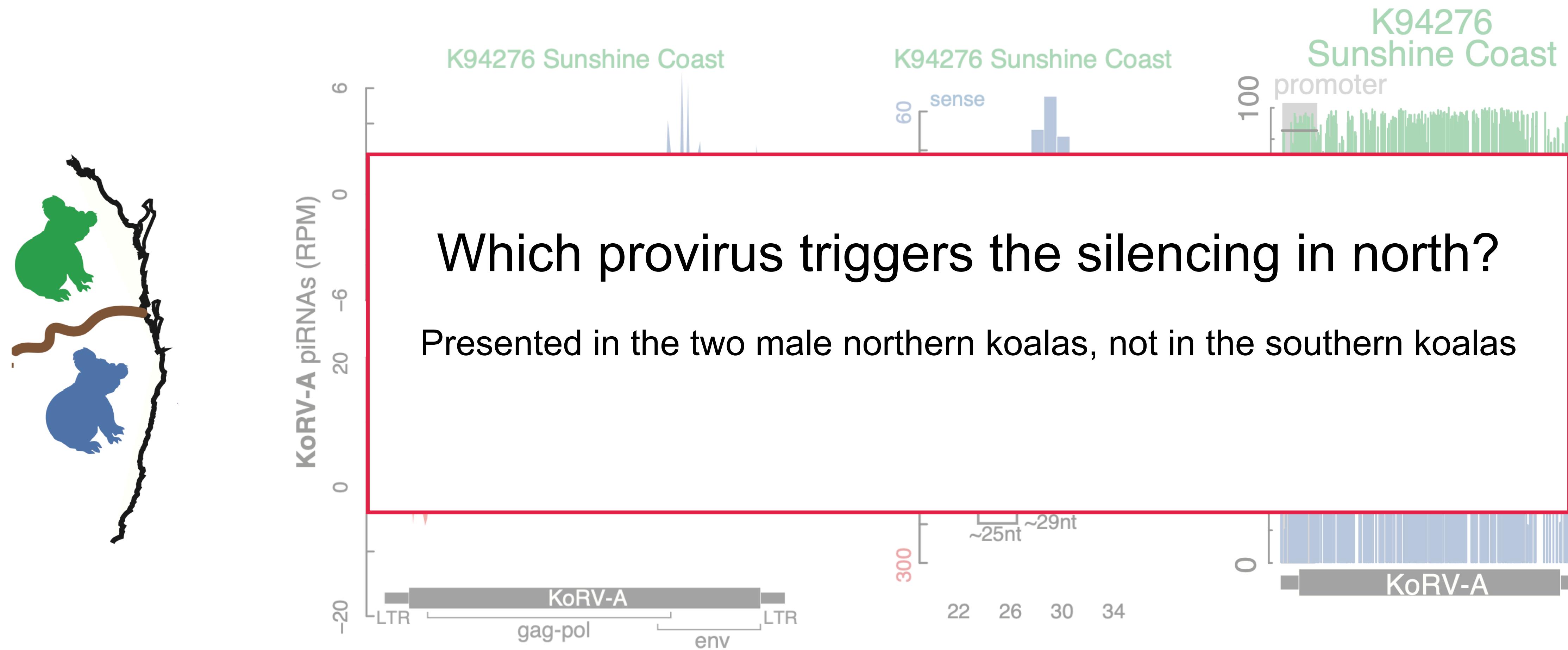
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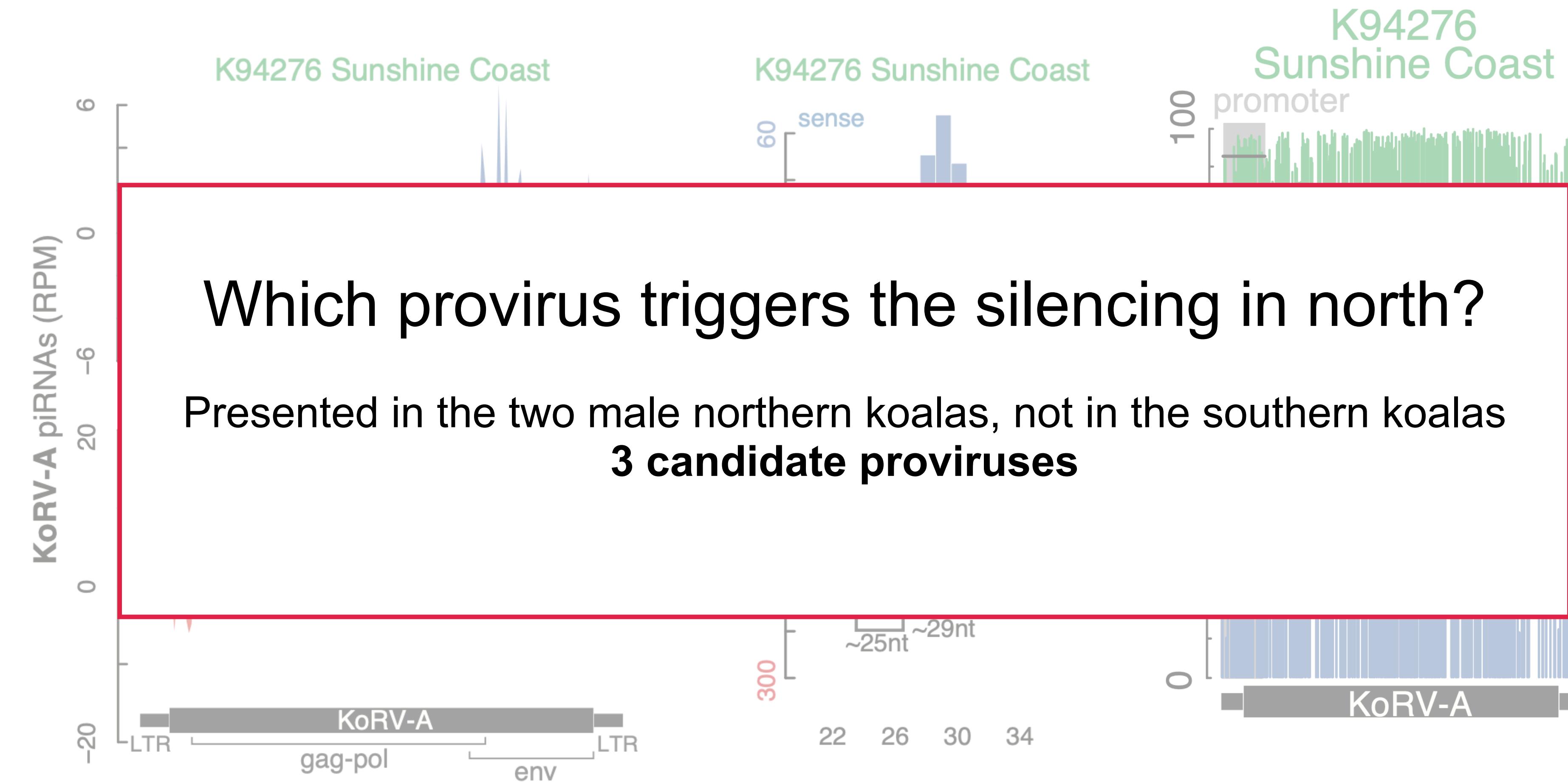
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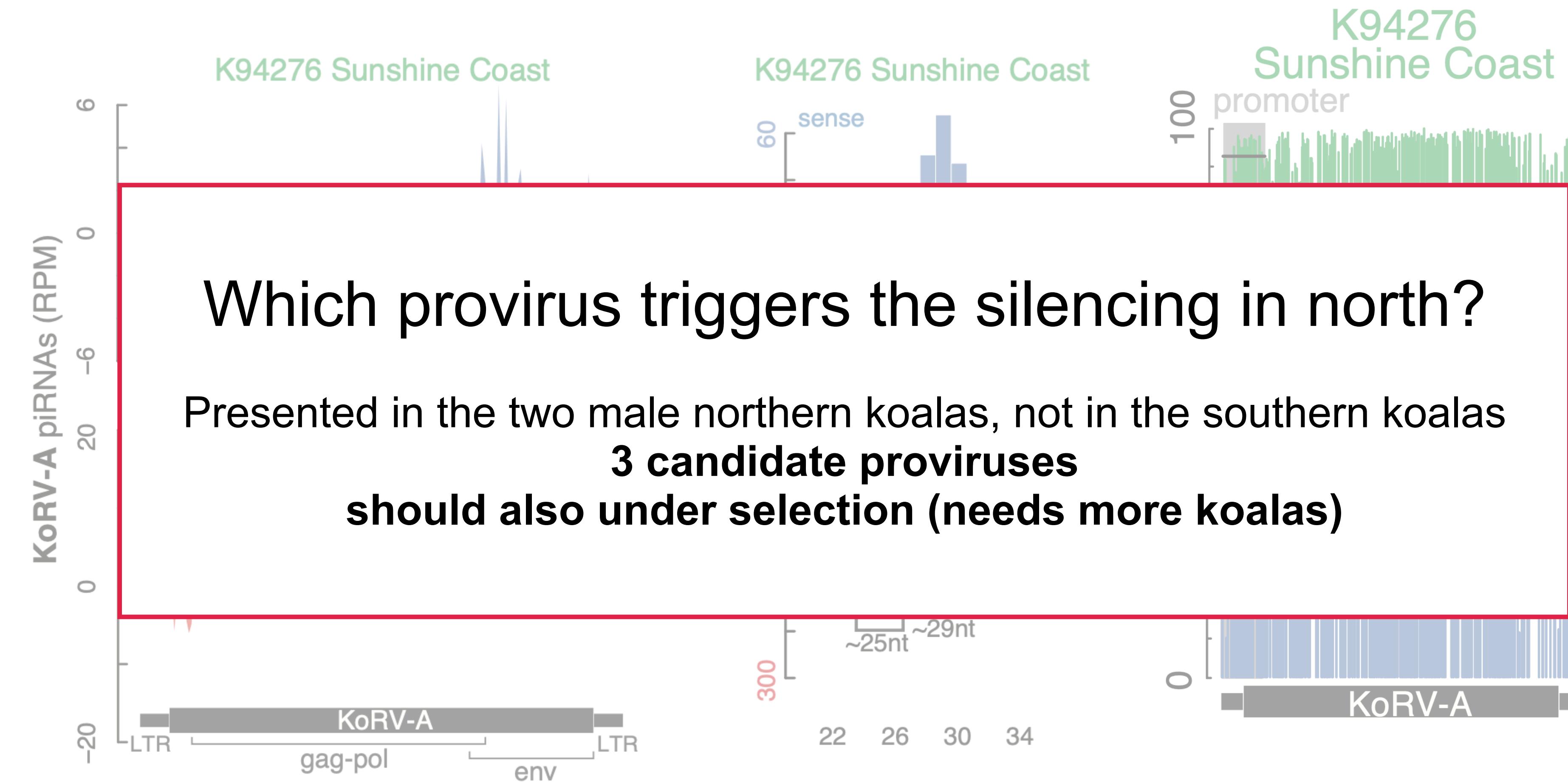
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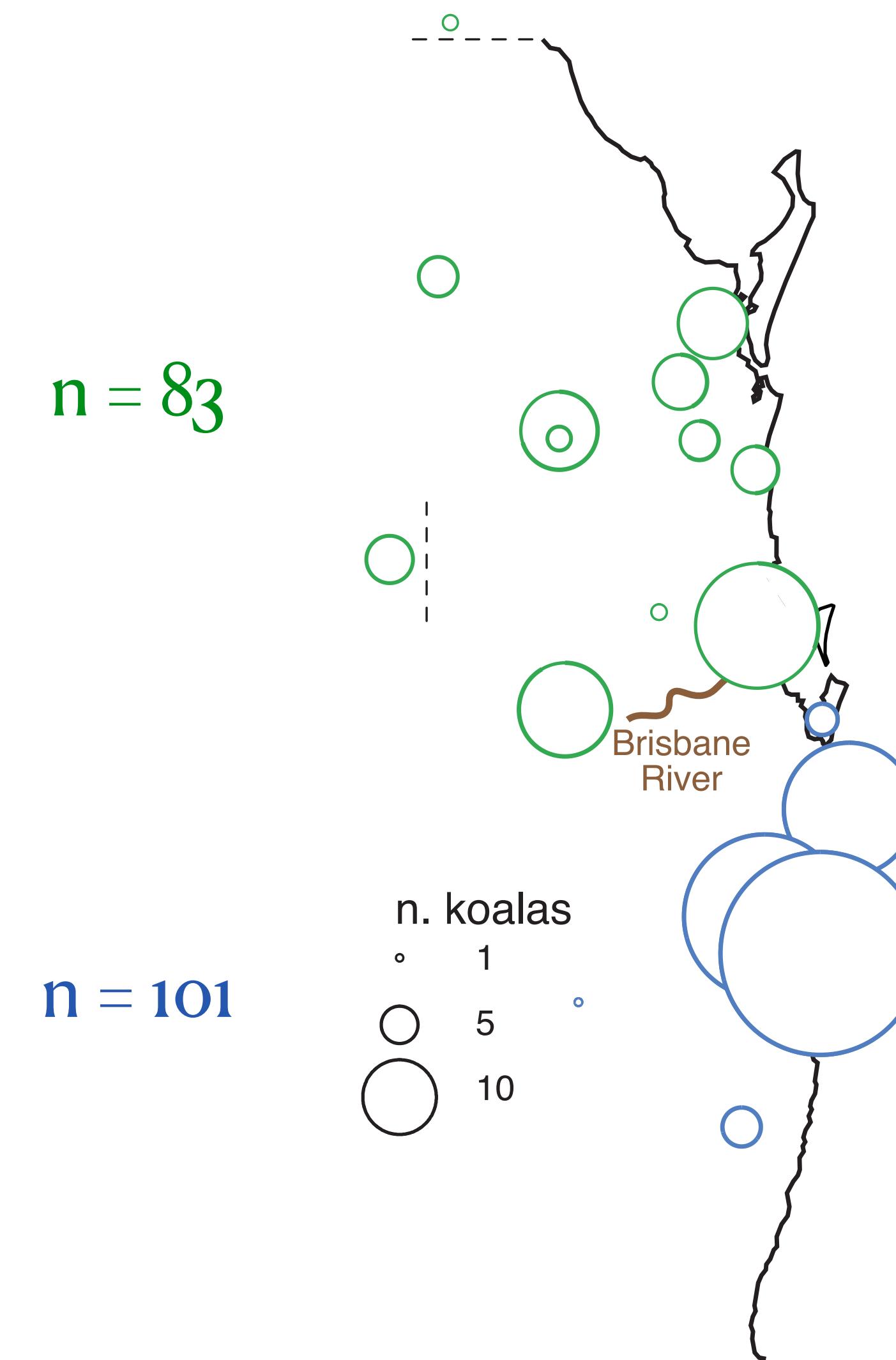
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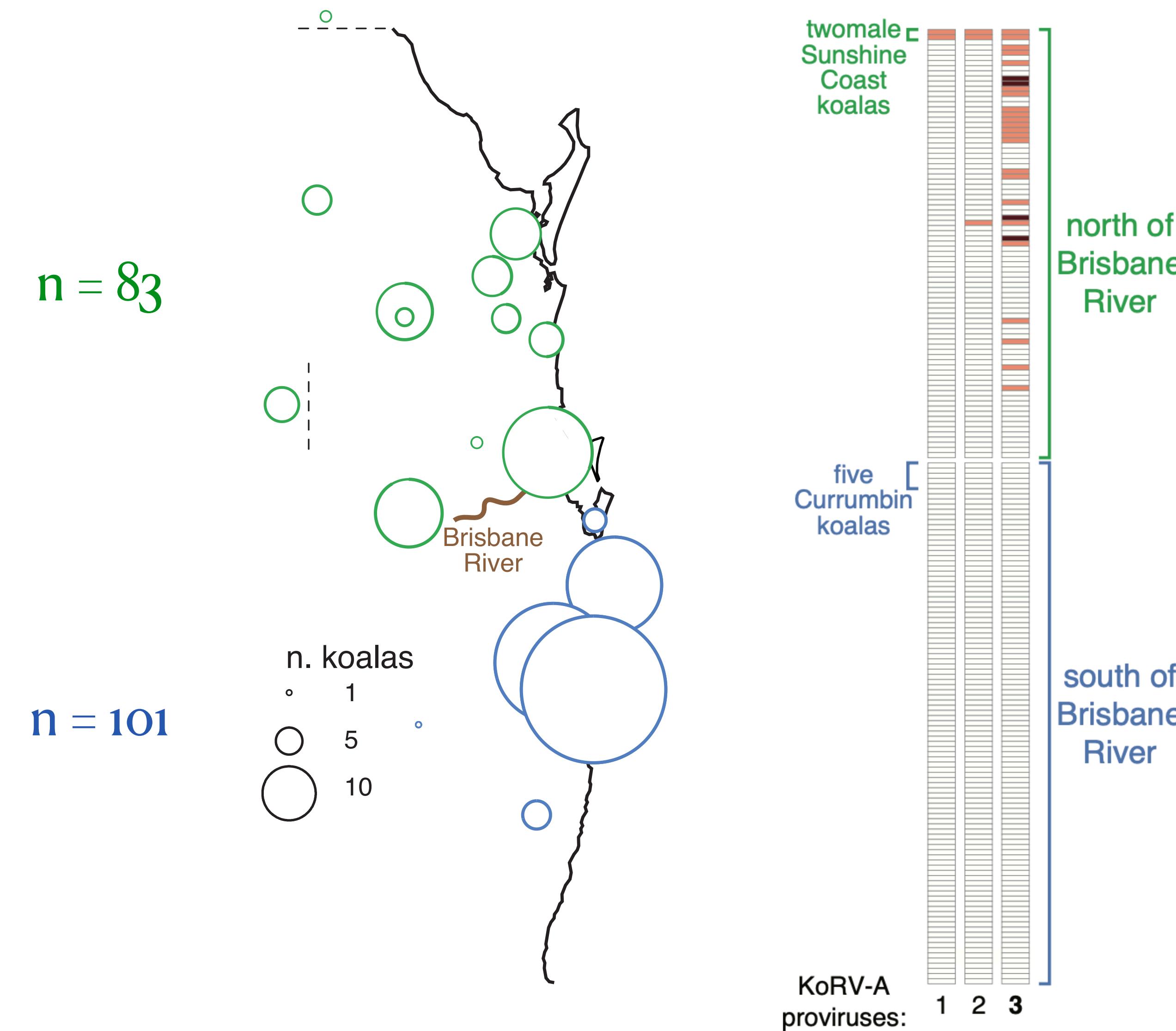
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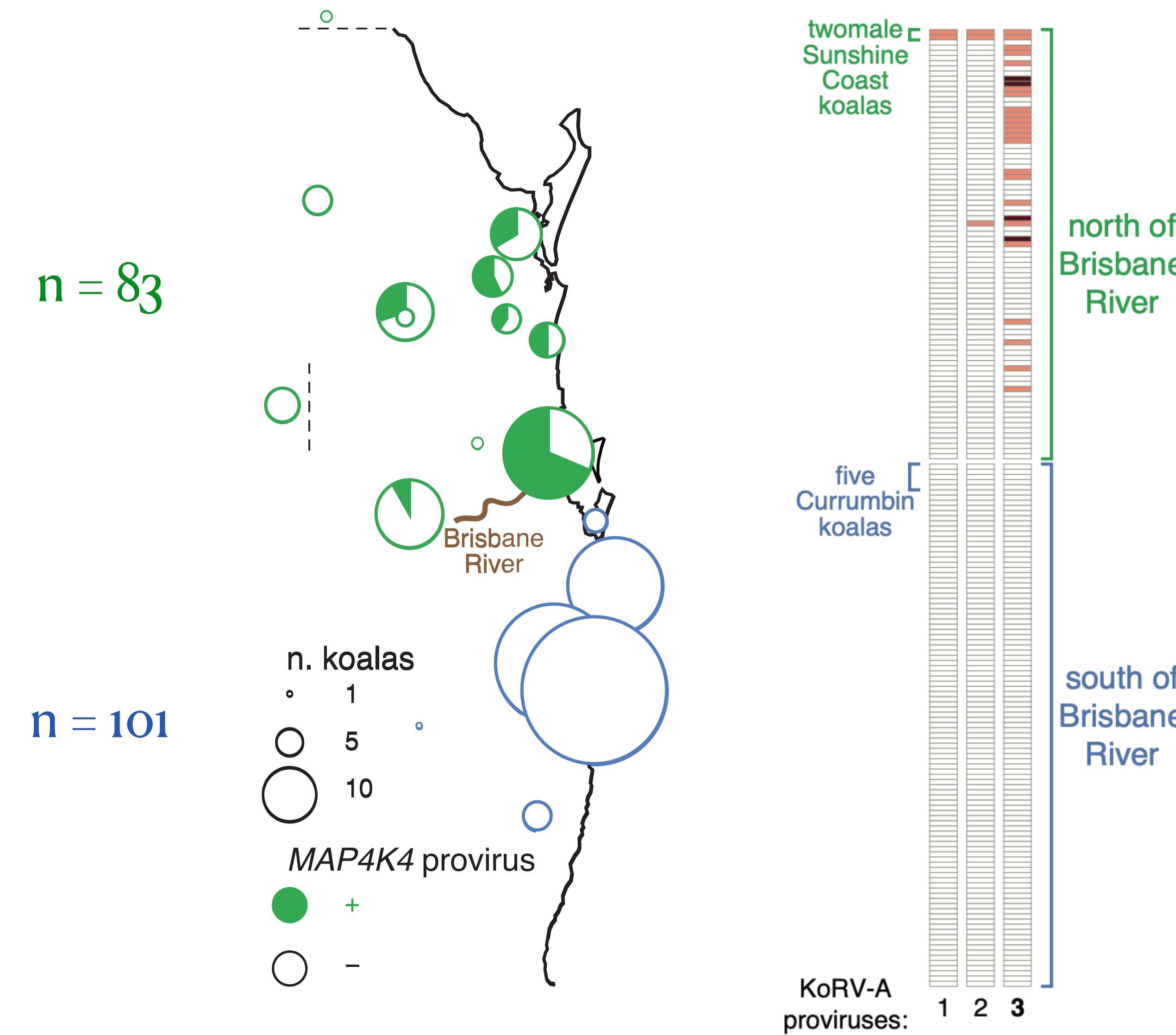
Identification of the trigger provirus for KoRV-A silencing



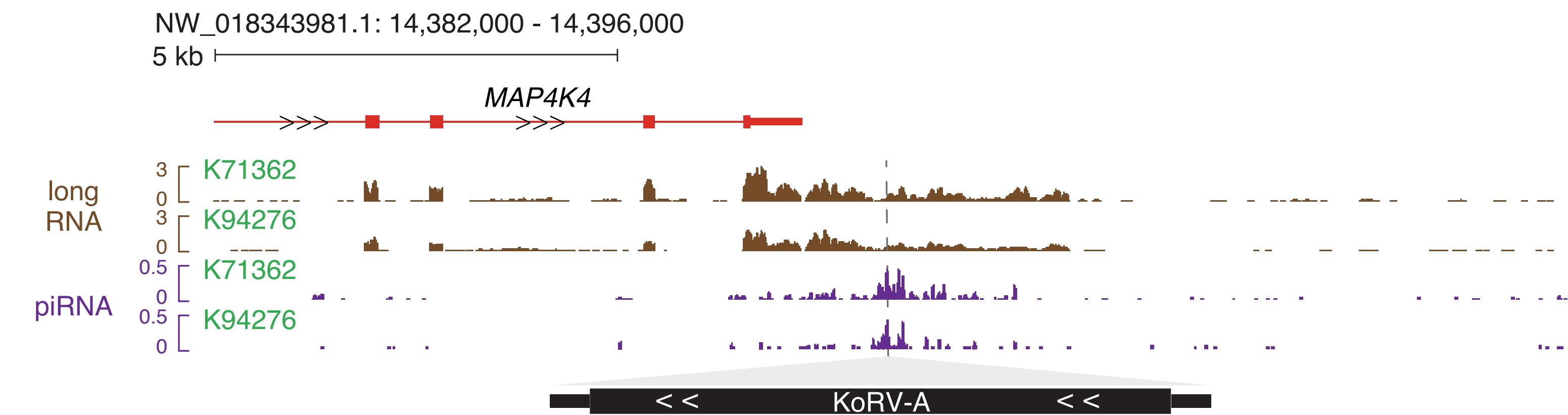
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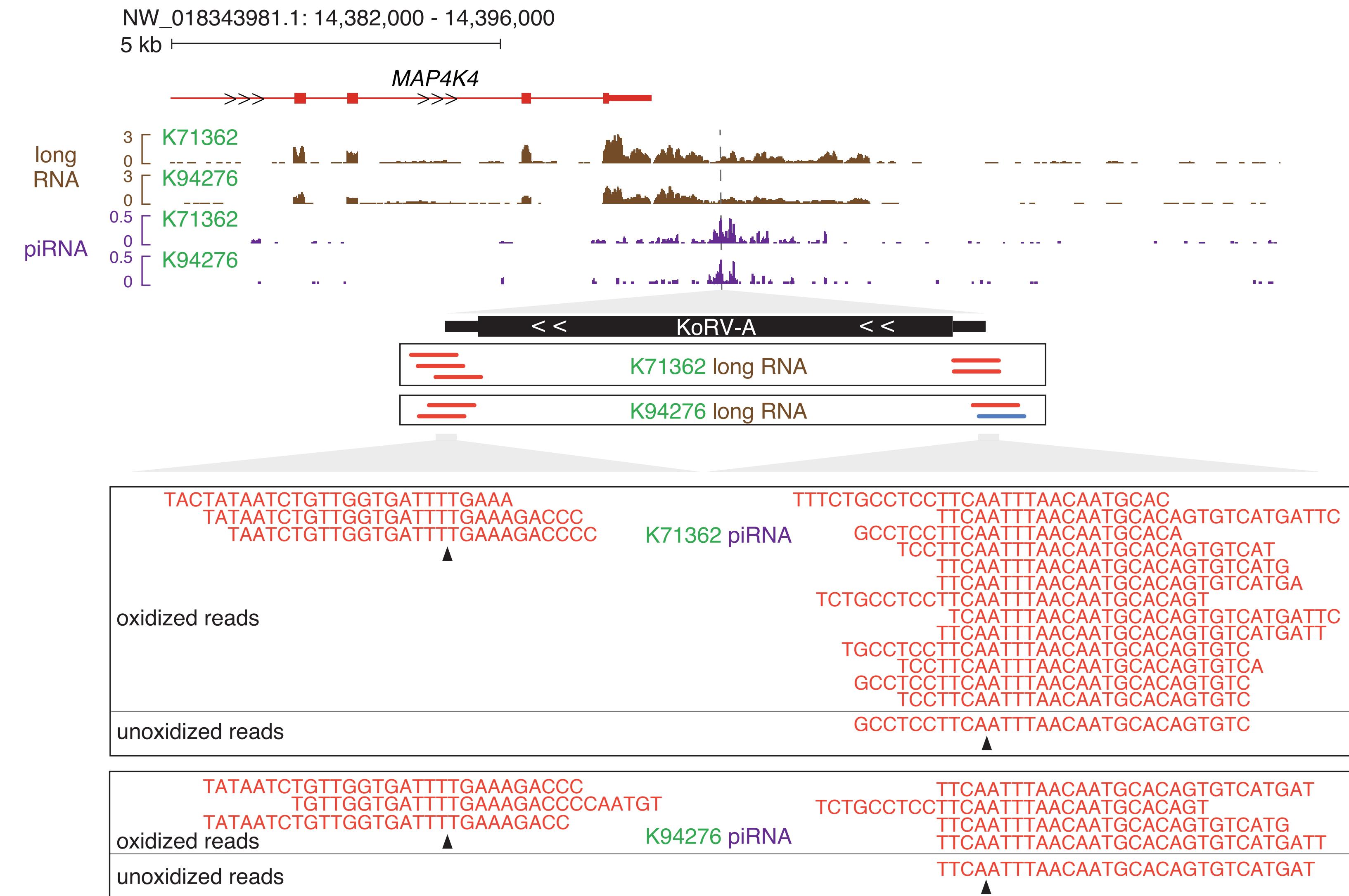
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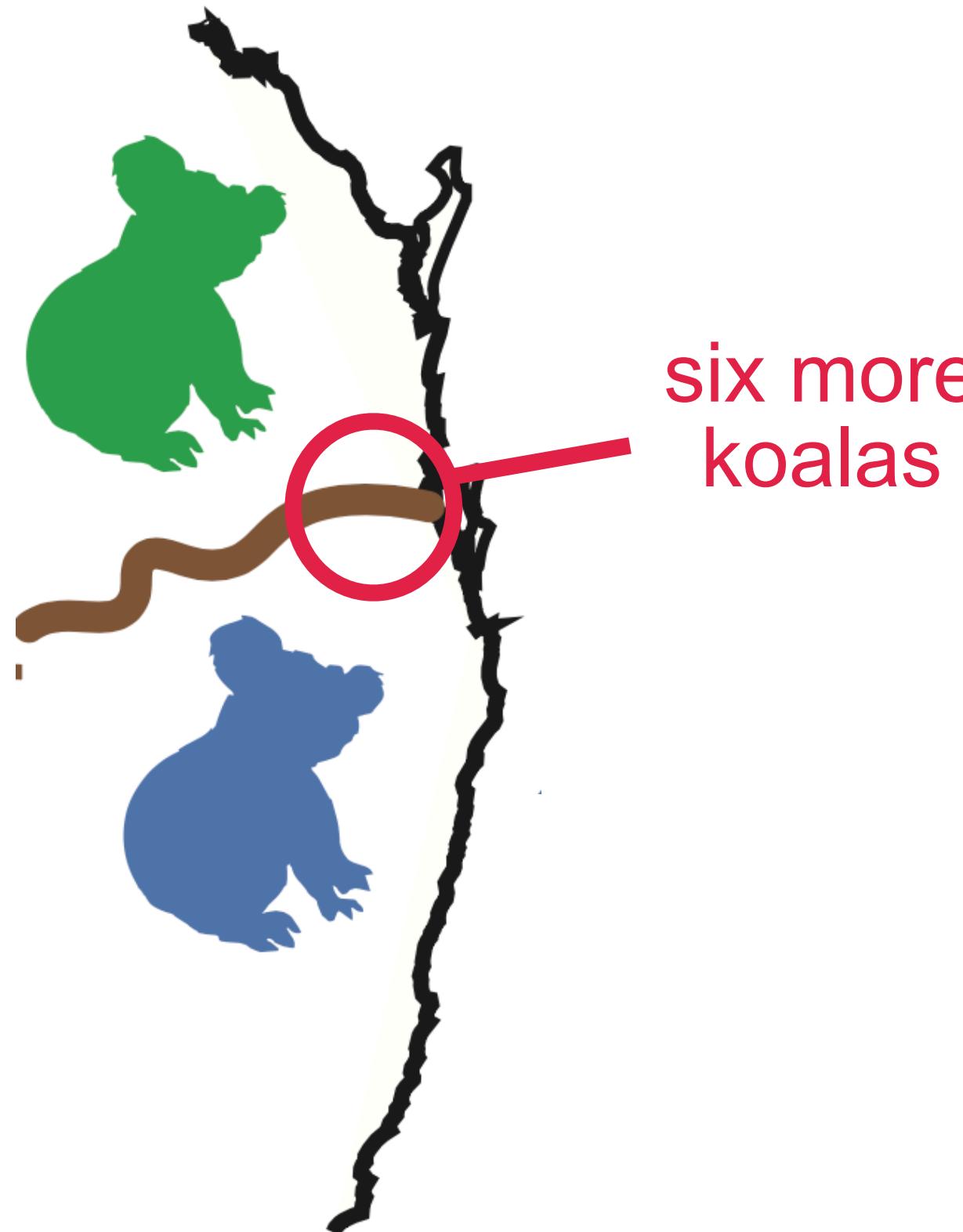
The trigger provirus is in the 3'UTR of a gene



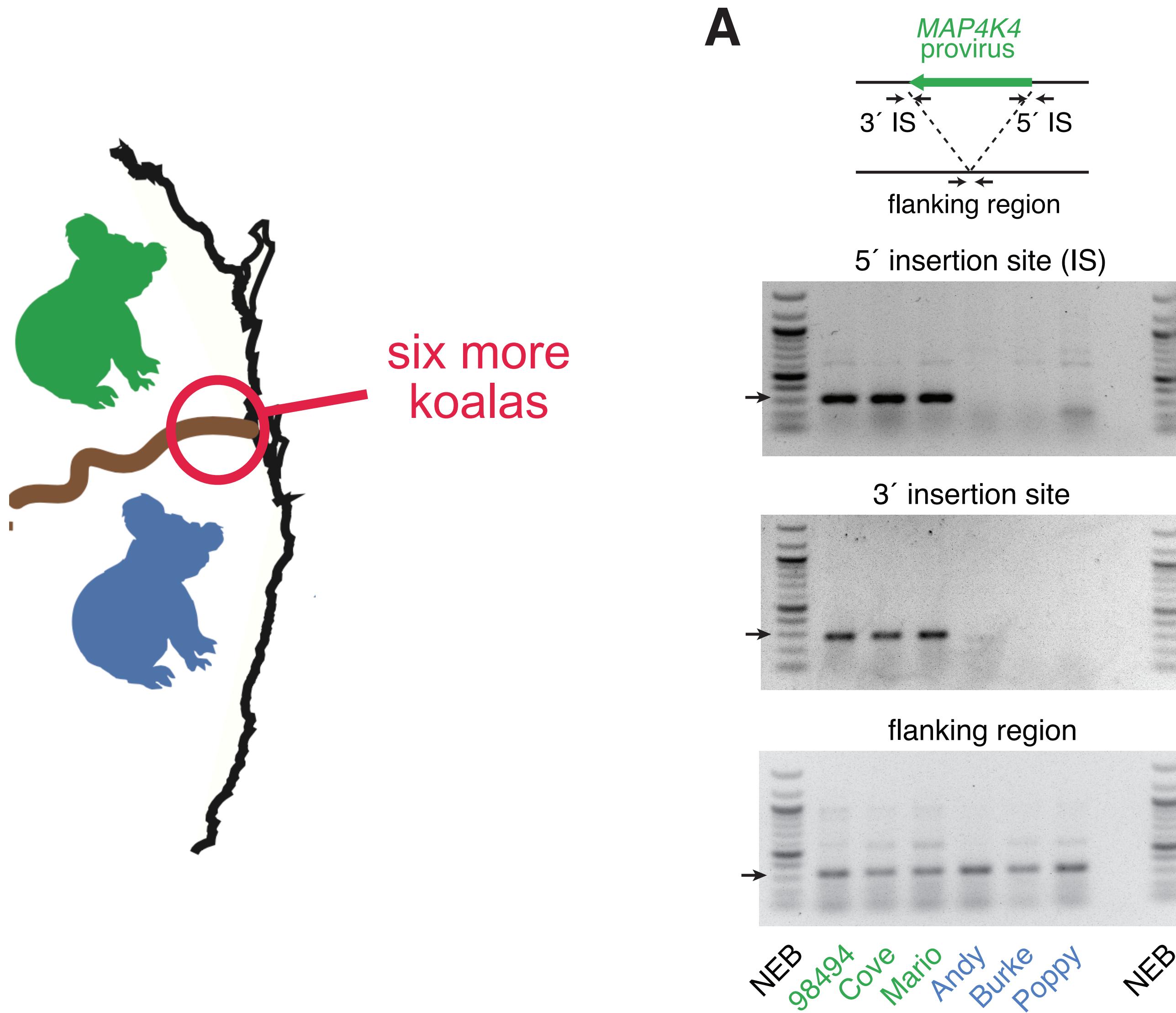
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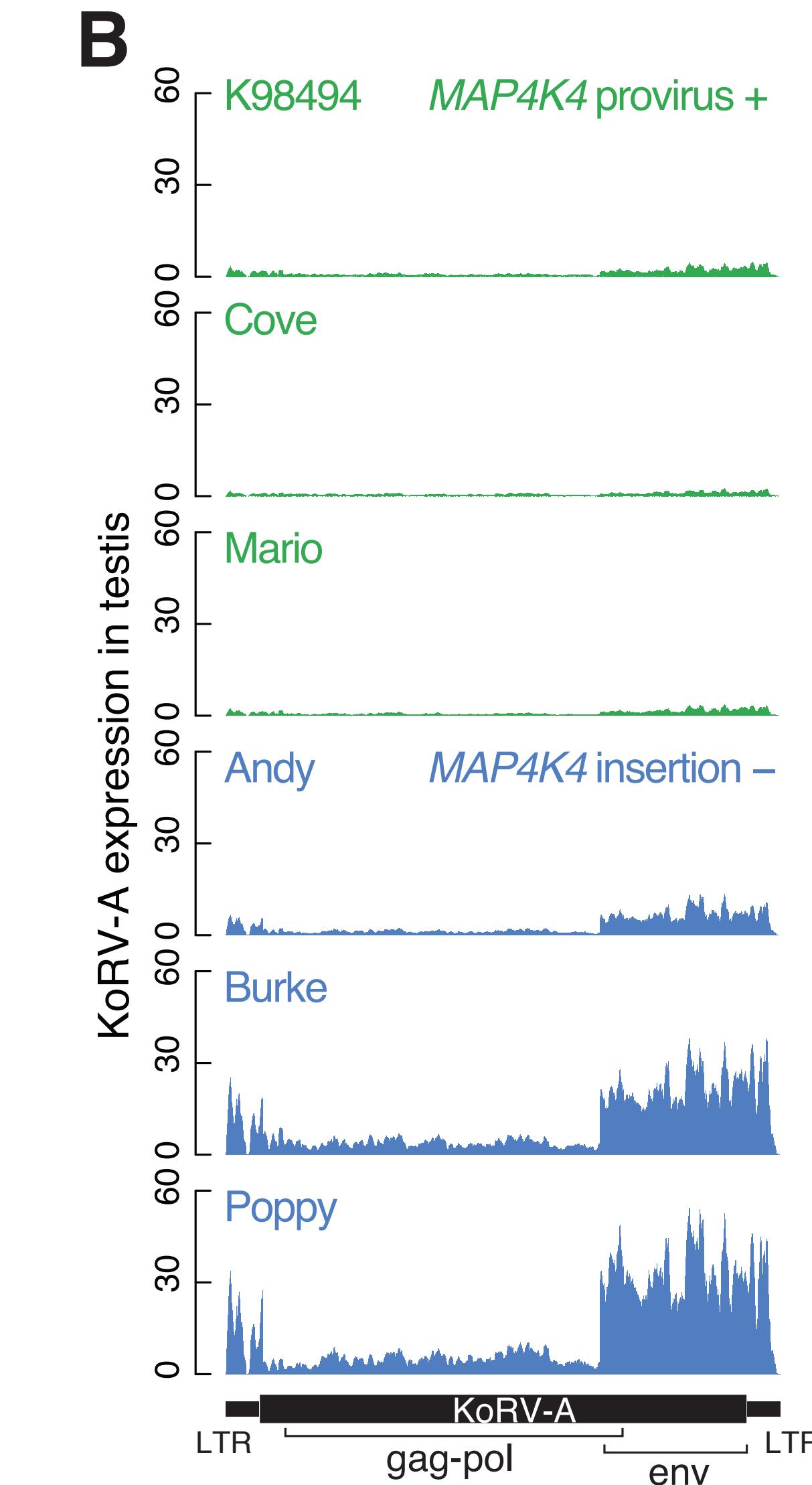
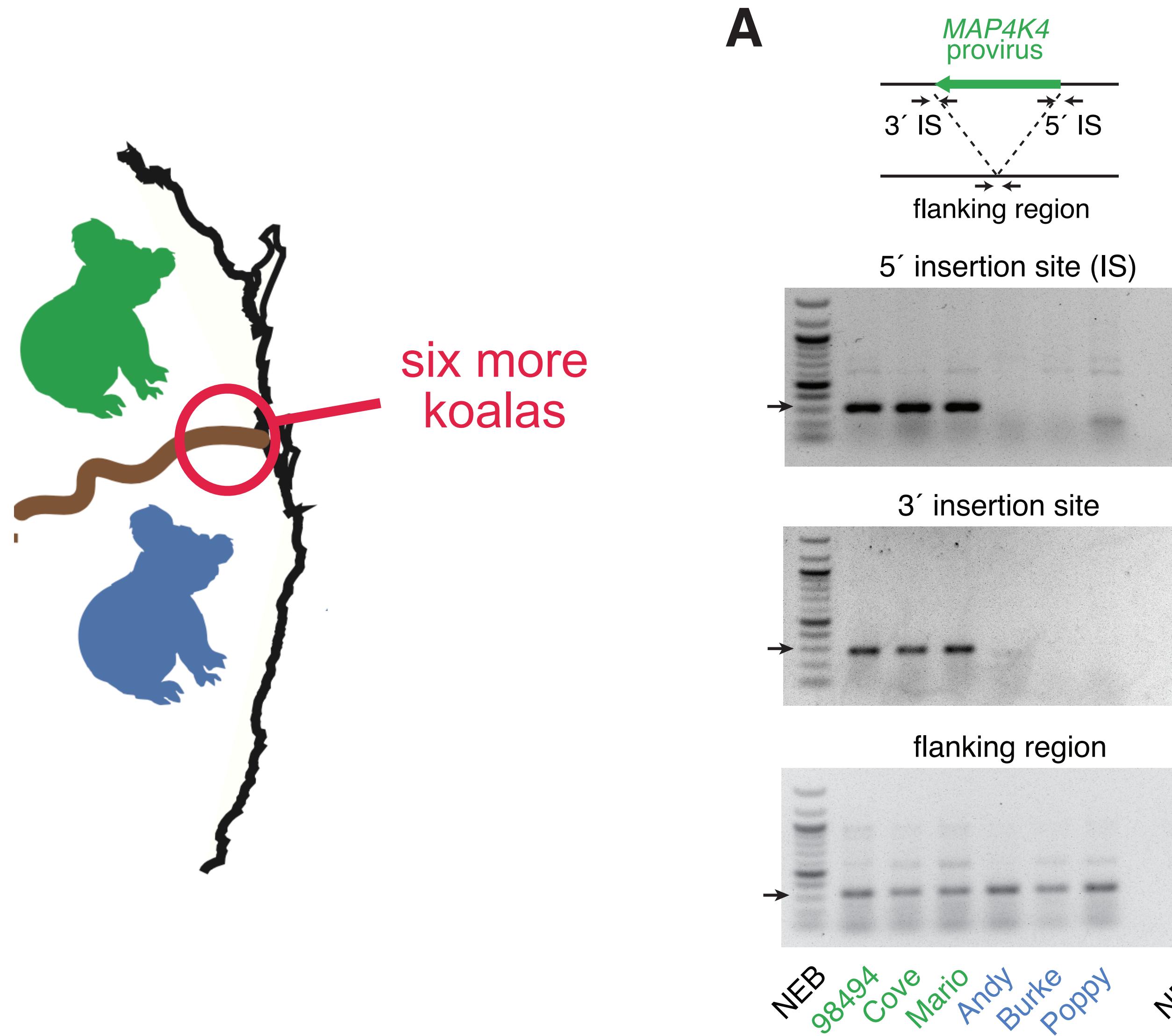
Further validation of the trigger provirus



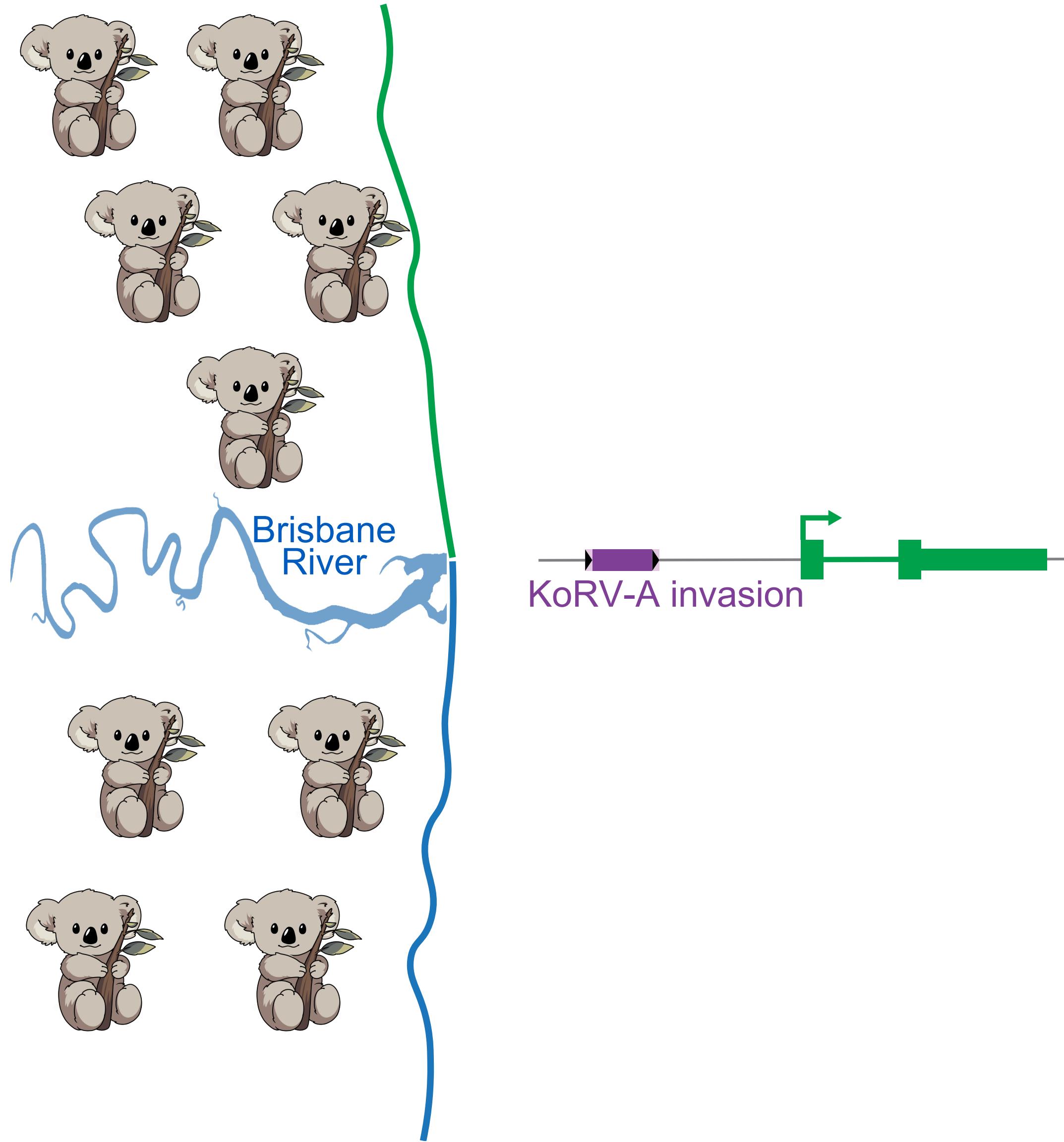
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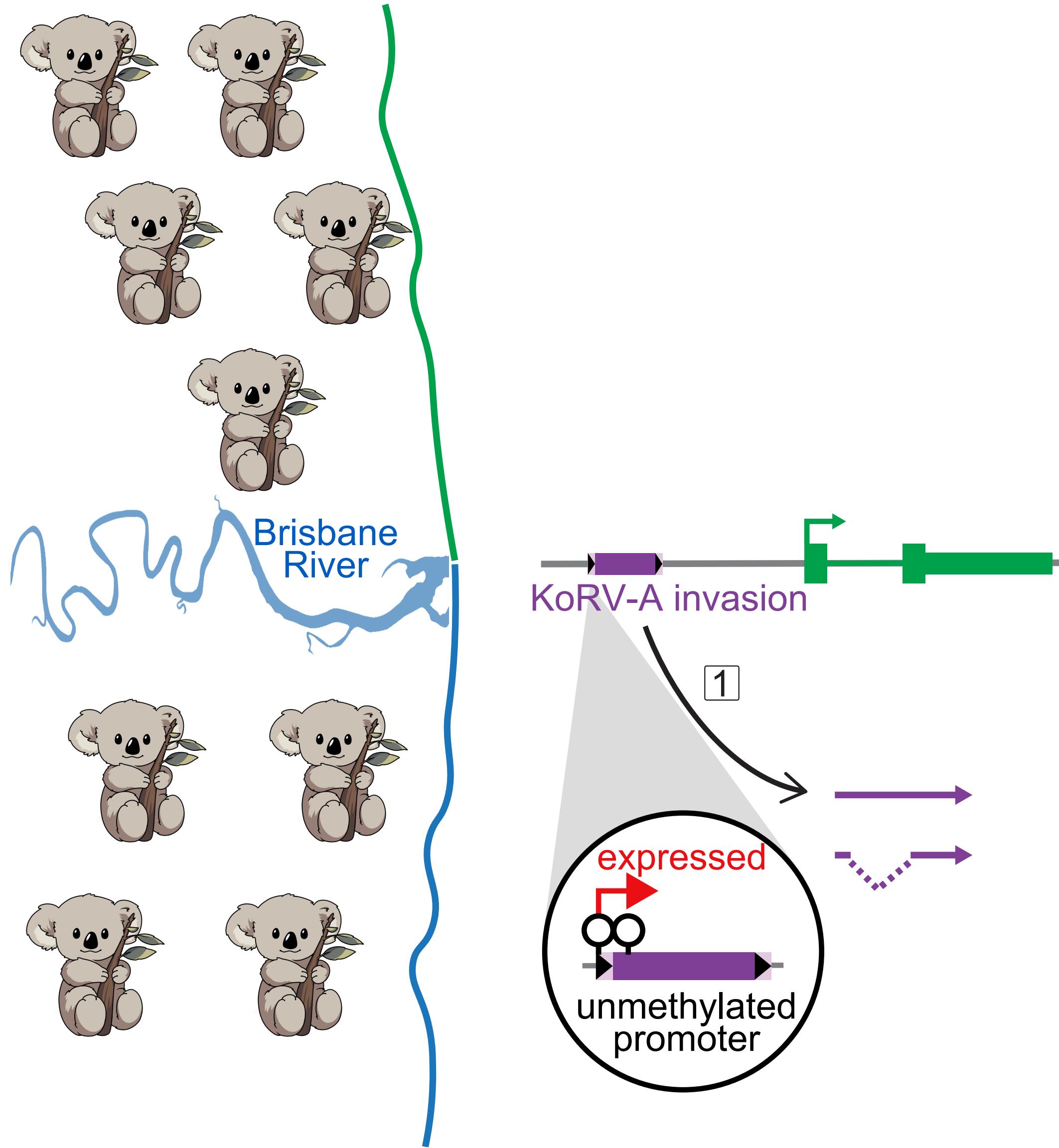


Summary: a two-phased genome response to retroviral invasion



- Retrovirus invades the germline genome

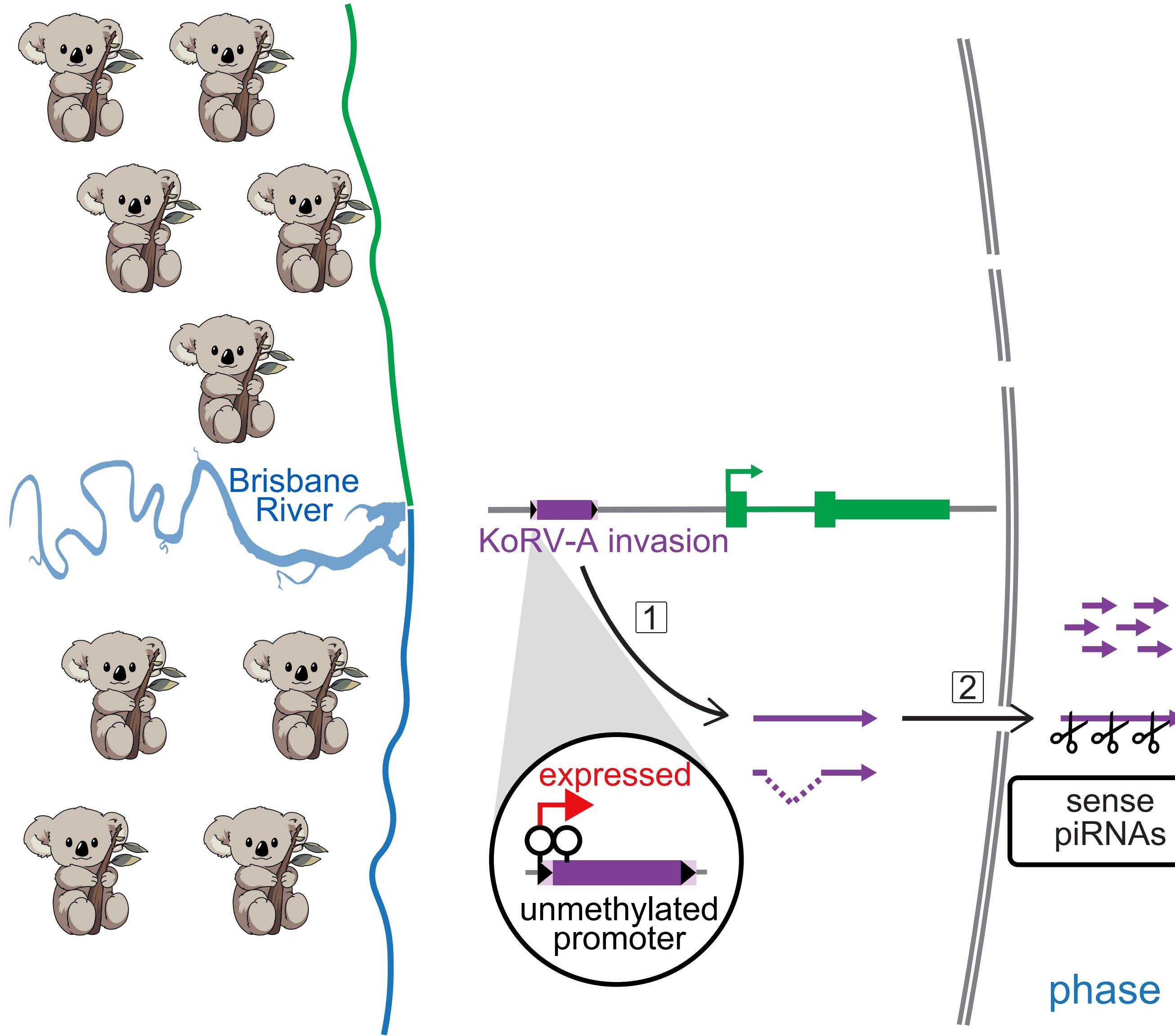
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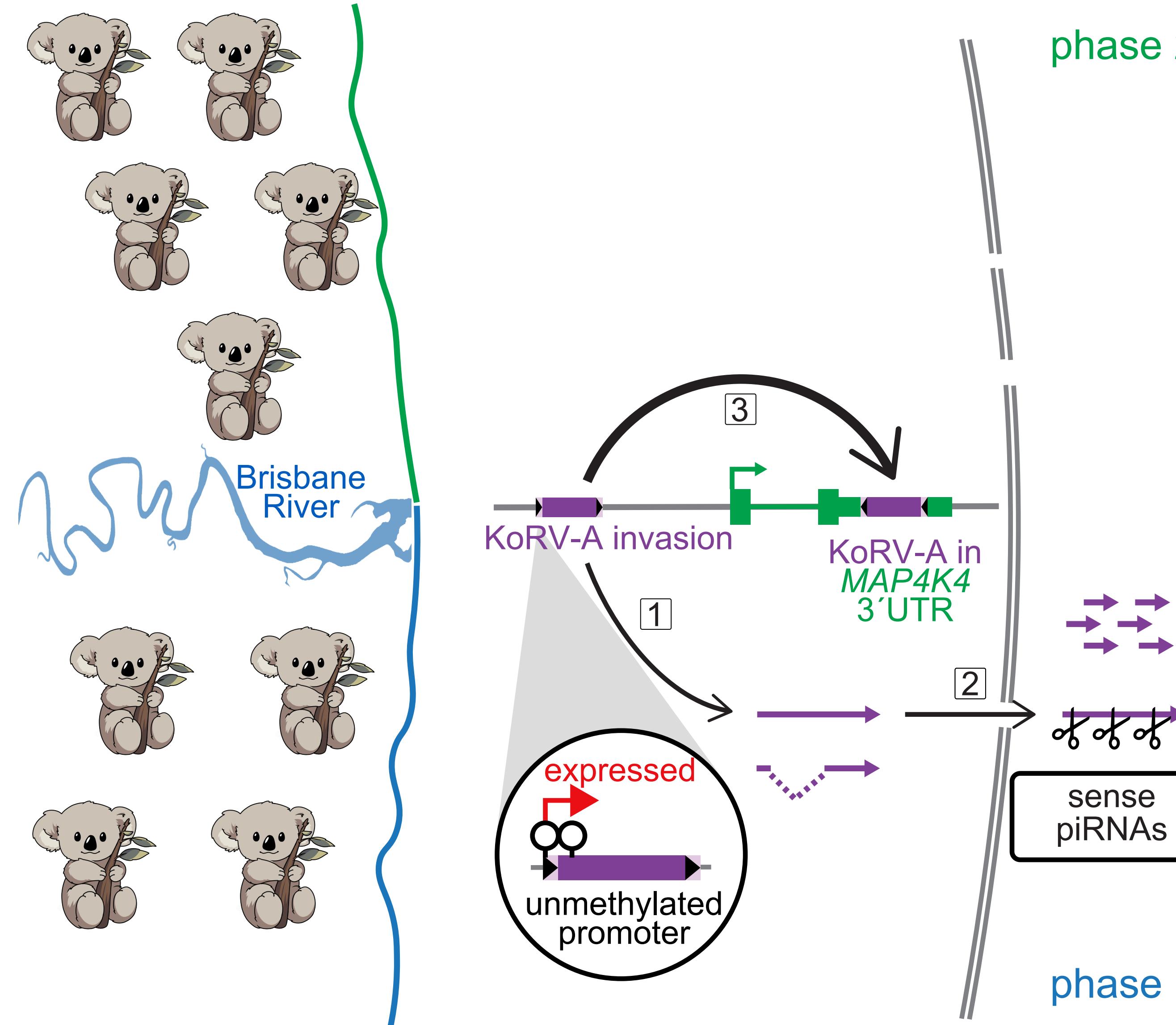
phase 1

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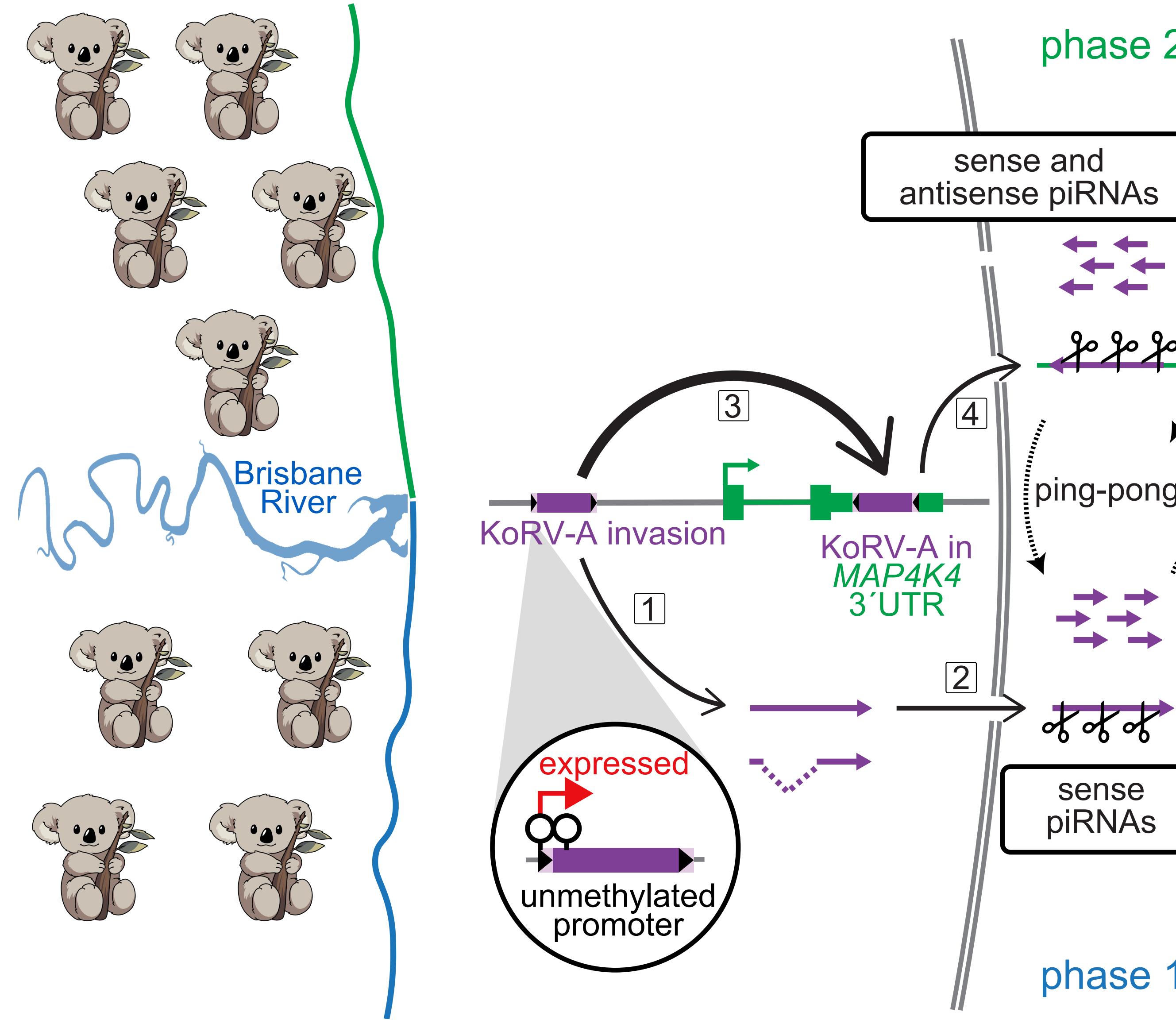
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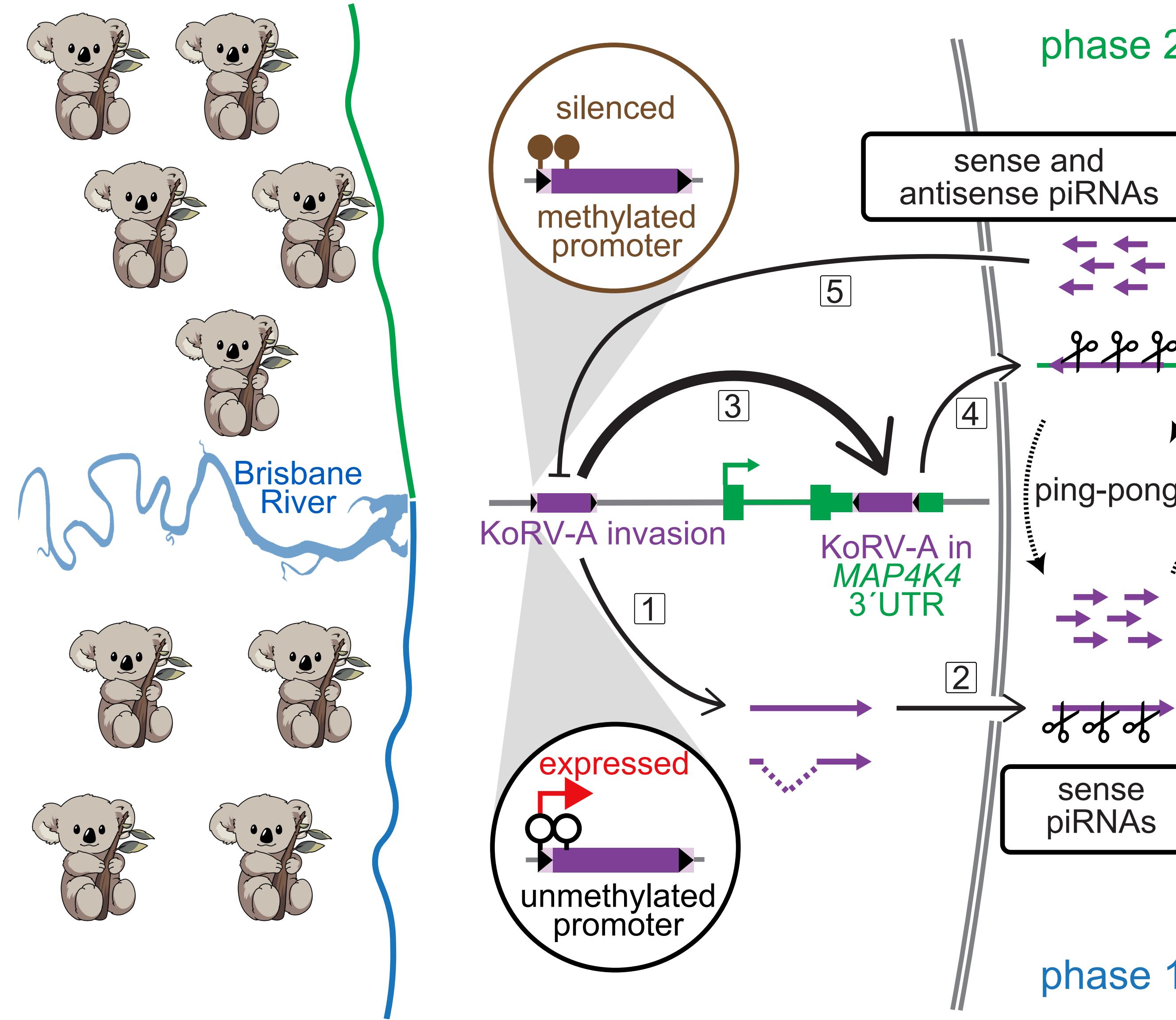
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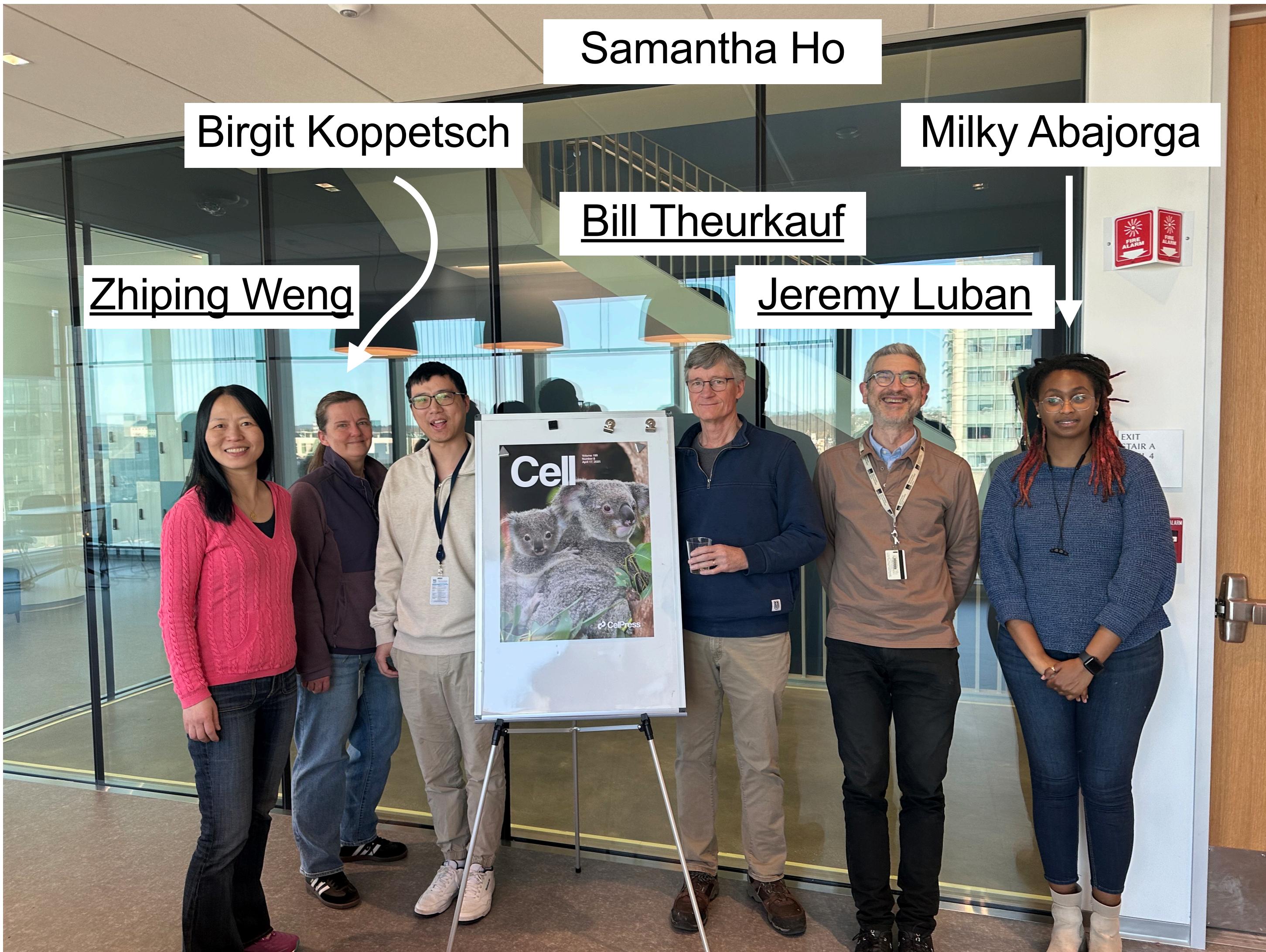
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Acknowledge



University of Queensland:

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Michaela Blyton



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