Unraveling the genetic and epigenetic impacts of large-scale chromosomal rearrangements in *Arabidopsis thaliana*

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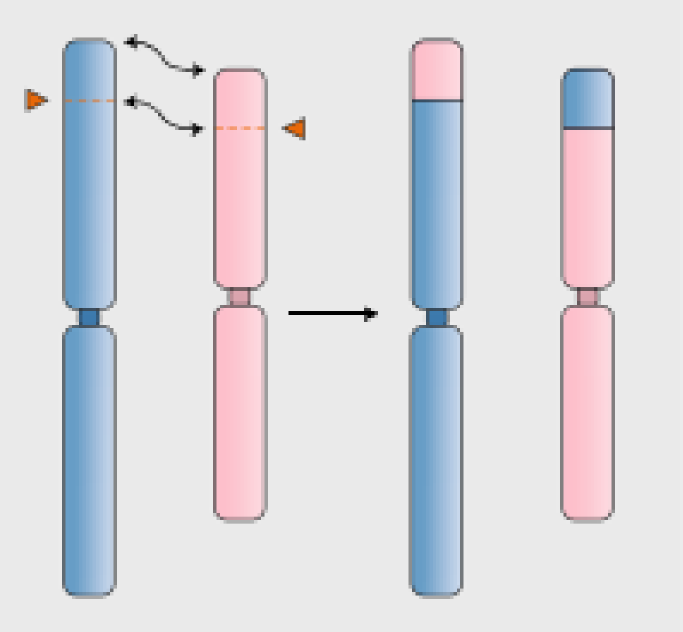
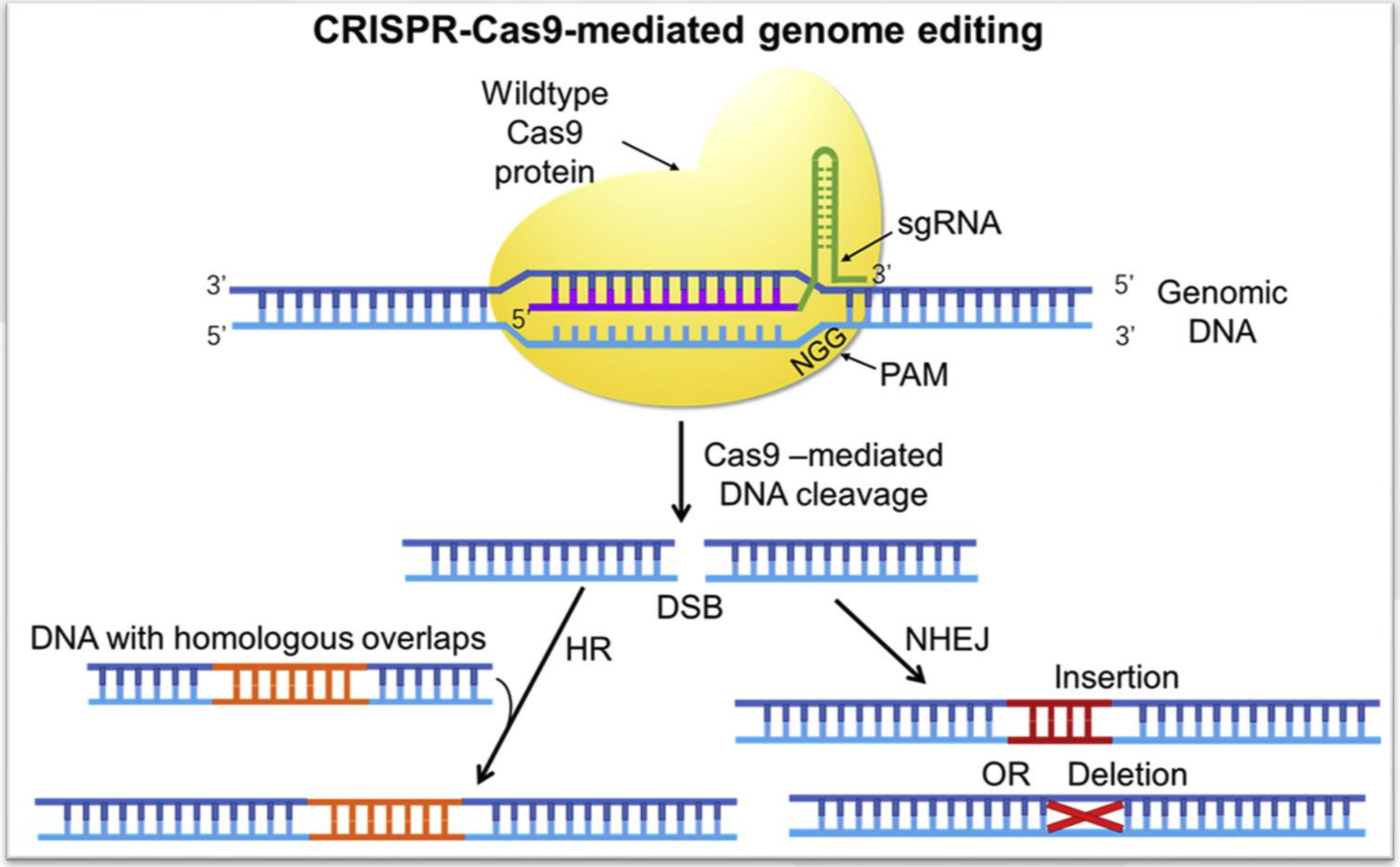
Rise to large-scale chromosome remodelling

- two DSBs on **heterologous** chromosomes
  - **reciprocal translocations**

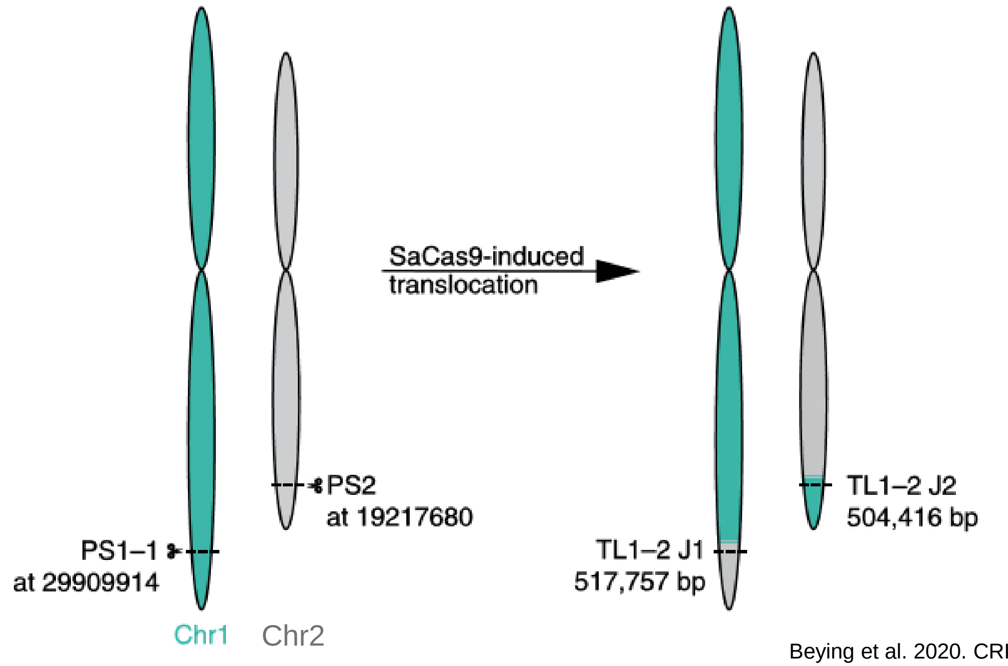


Rönspies et al. 2022. CRISPR-Cas9-mediated chromosome engineering in *Arabidopsis thaliana*. Nat Prot 17, 1332-58.

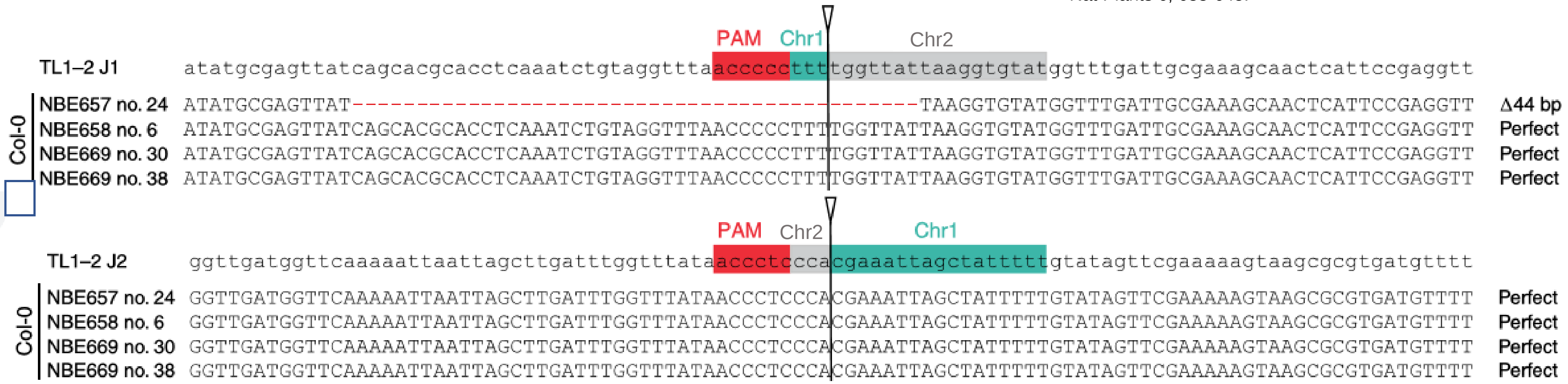


Tian et al. 2017. Fundamental CRISPR-Cas9 tools and current applications in microbial systems. Synth Sys Biotechnol 2, 219–225.

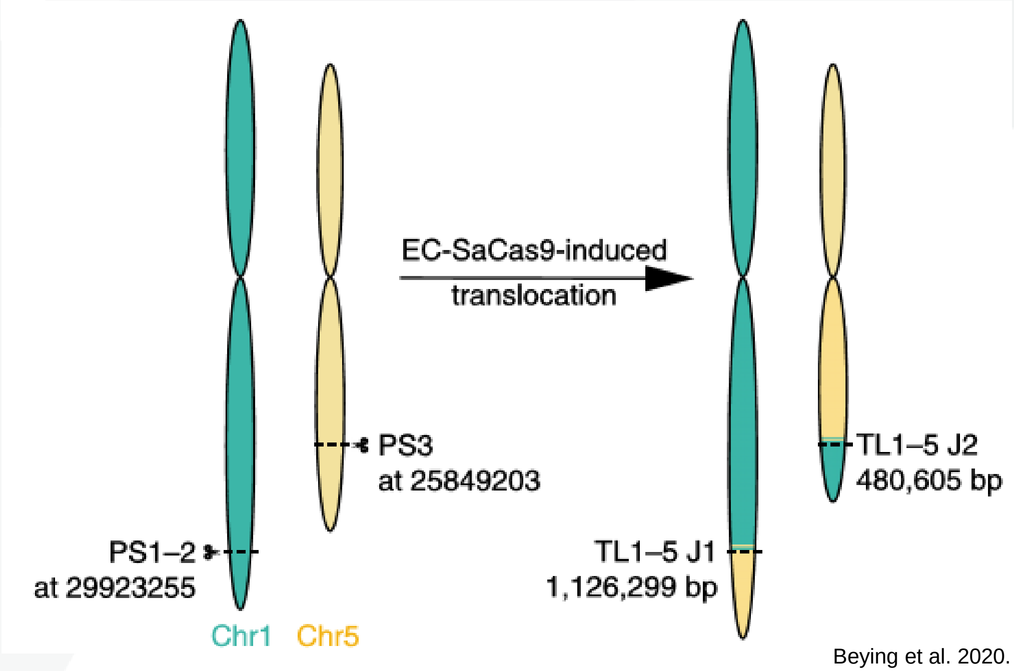
Plants with translocated chromosome arms



Beying et al. 2020. CRISPR-Cas9-mediated induction of heritable chromosomal translocations in *Arabidopsis*. Nat Plants 6, 638-645.



Plants with translocated chromosome arms



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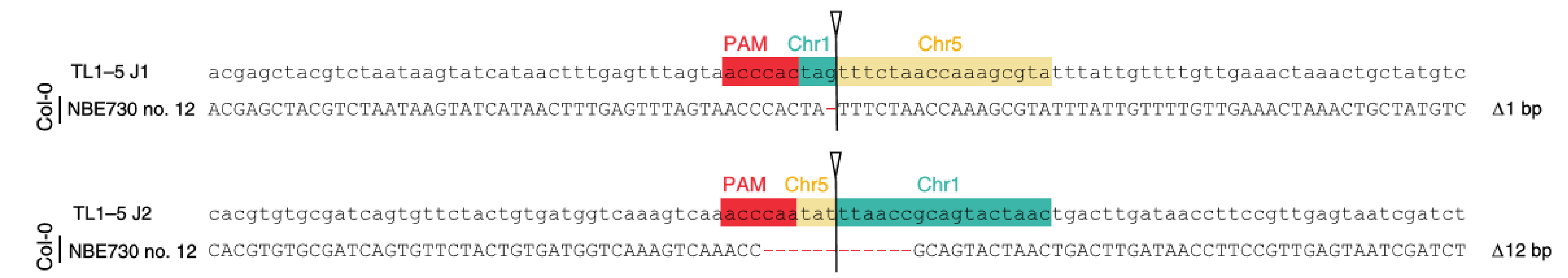
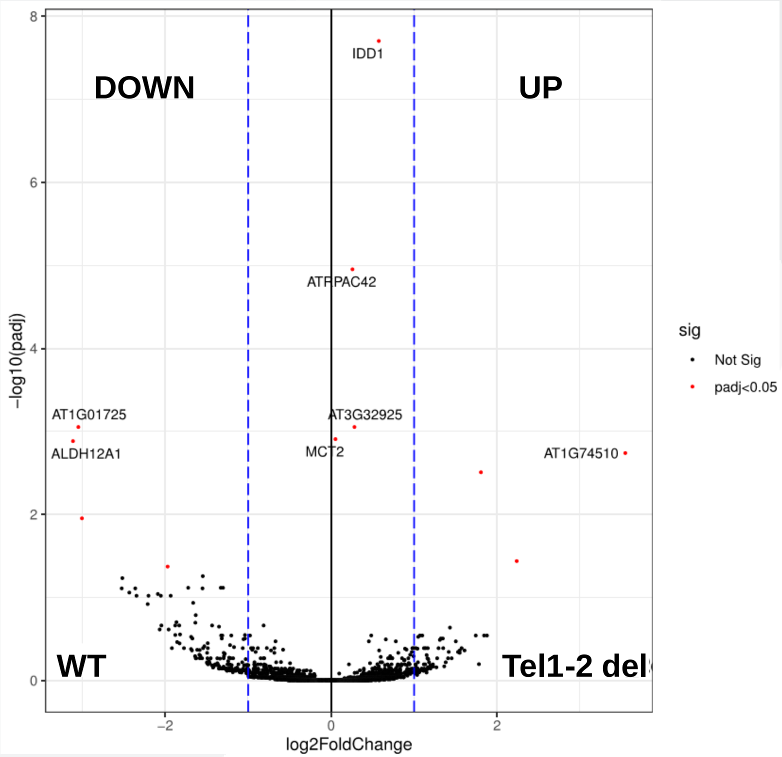
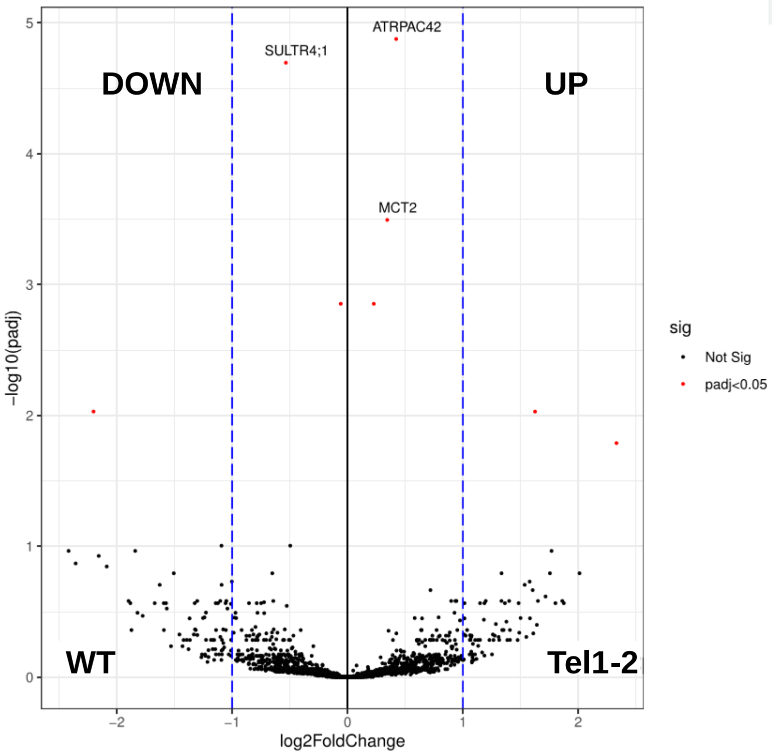


What are the long-term consequences of **large-scale chromosome re-arrangements** for plant well-being, gene expression, and telomere maintenance?

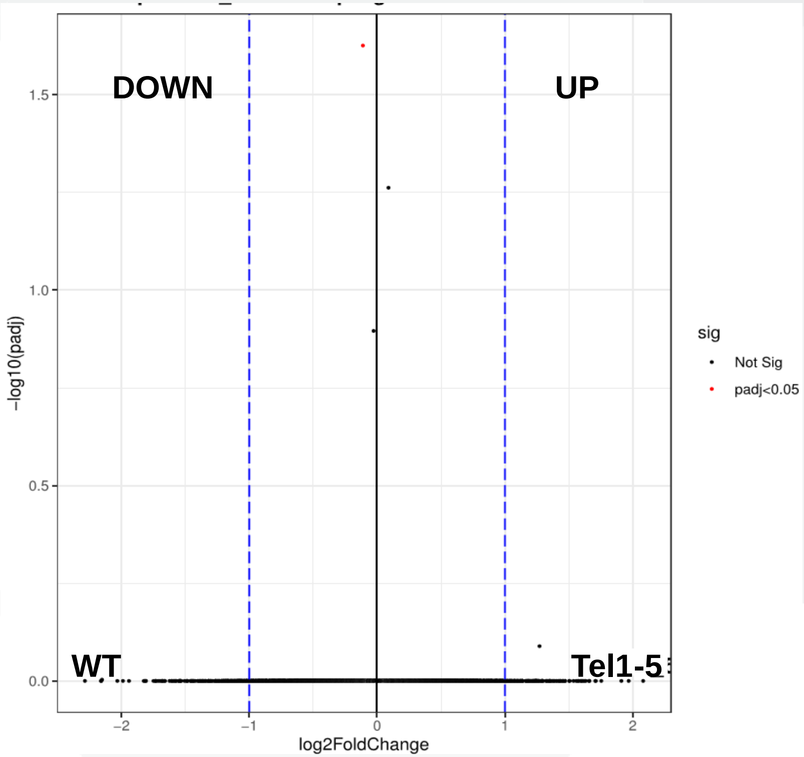
Levels of transcripts comparable



TL1-2 del vs WT

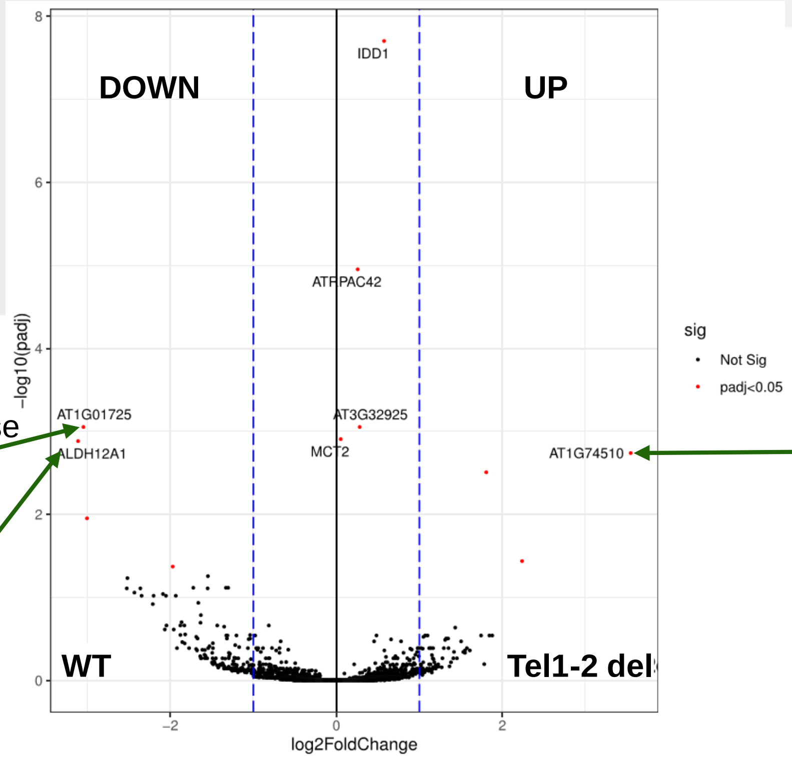


TL1-2 vs WT



TL1-5 vs WT

Levels of transcripts comparable



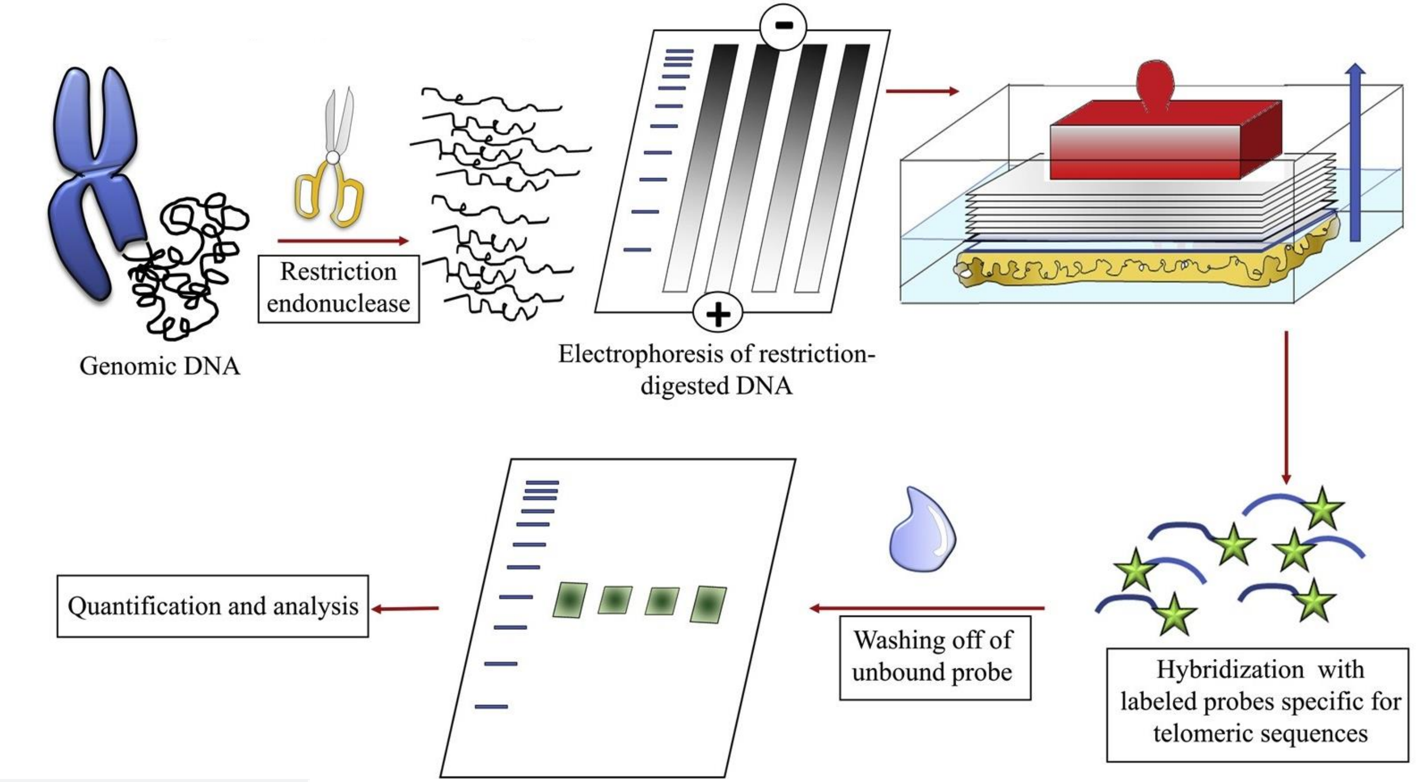
adenylosuccinate synthetase
~ 29 Mb from J1

aldehyde dehydrogenase 12A1 (AT5G62530)
Chr5

galactose oxidase/kelch repeat superfamily protein
~ 1.9 Mb from J1

TL1-2 del vs WT

Bulk telomeres lengths……..



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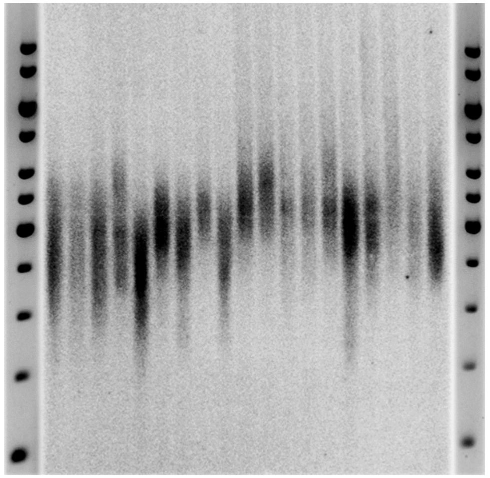
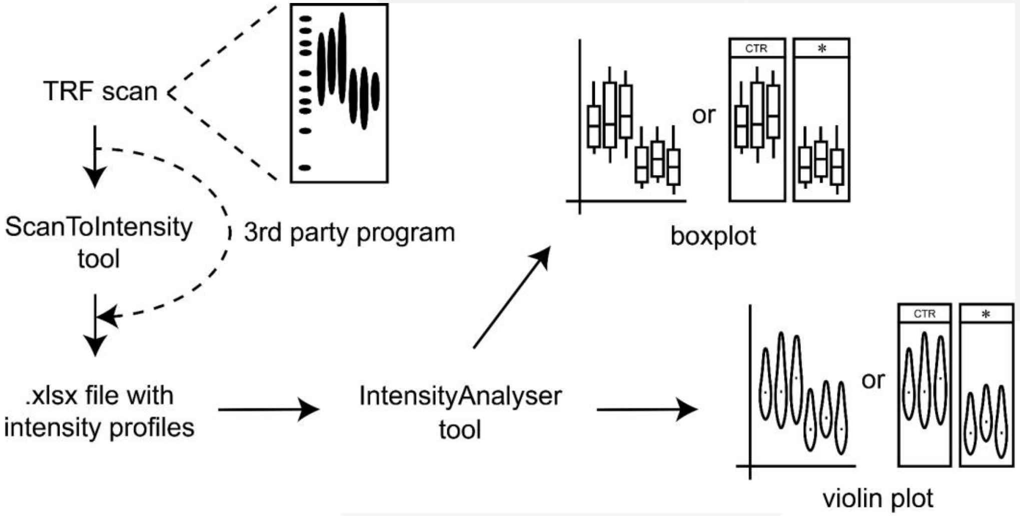


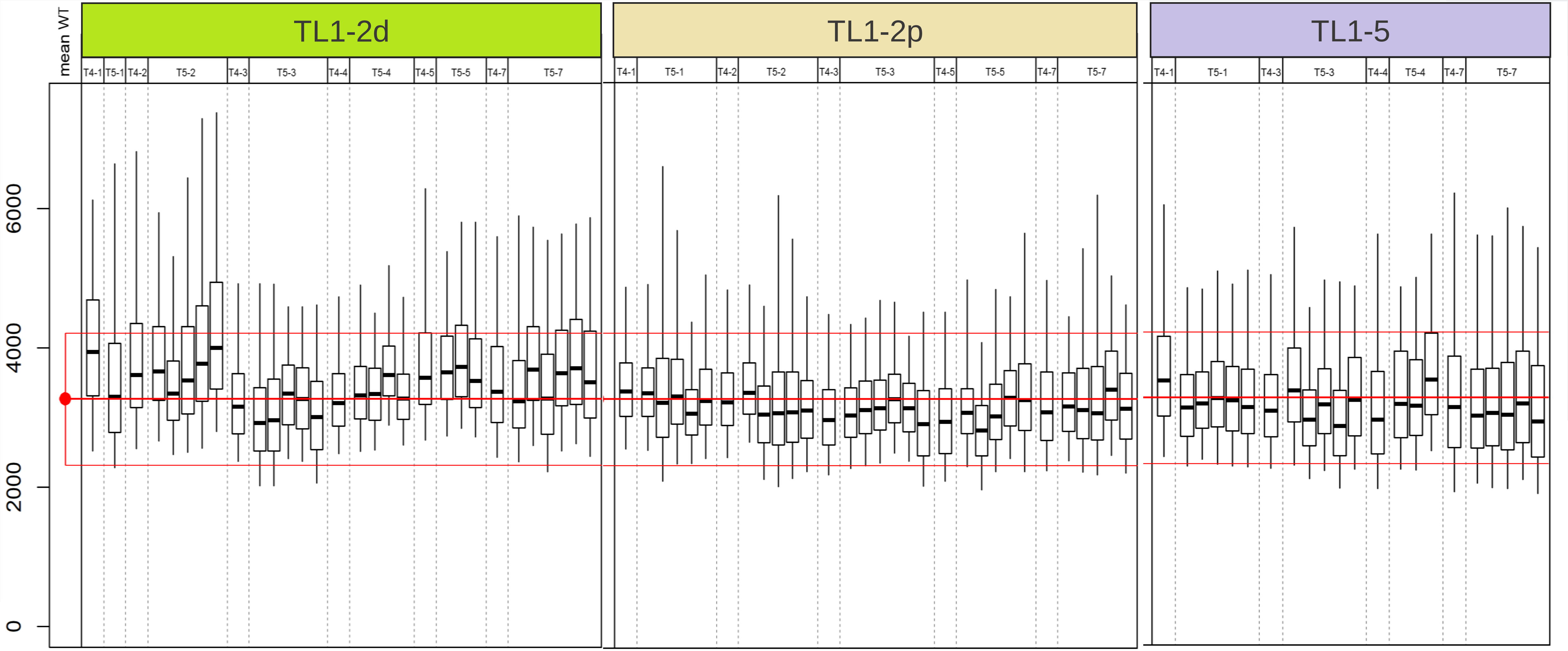
WALTER



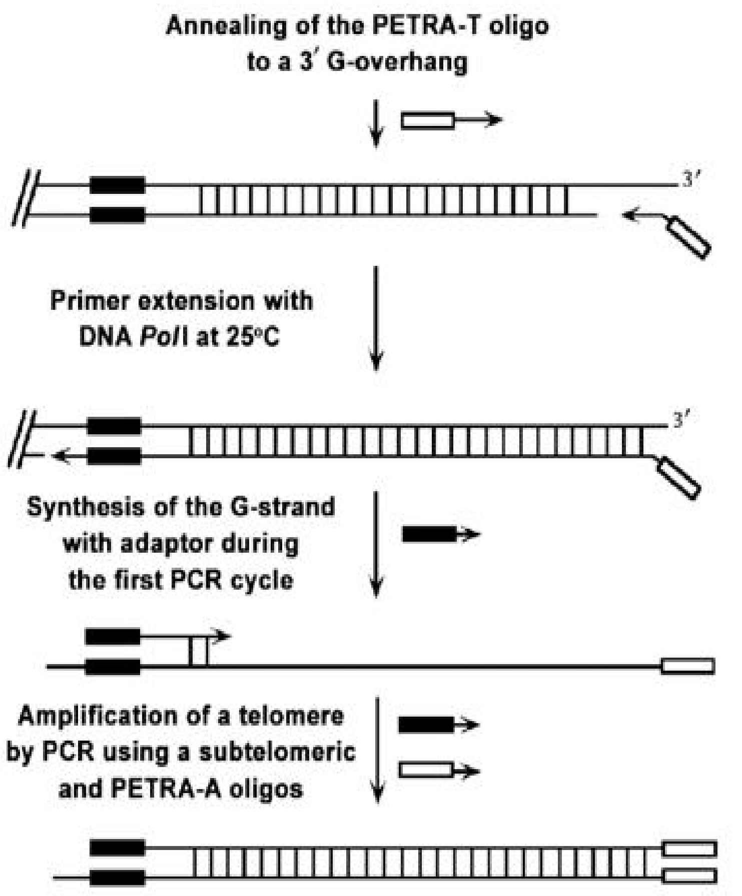
Lyčka M et al. 2021. WALTER: An easy way to online evaluate telomere lengths from terminal restriction fragment analysis. BMC Bioinformatics 22, 145

https://www.ceitec.eu/chromatin-molecular-complexes/rg51/tab?tabId=125#WALTER

Bulk telomeres lengths……..



Bulk telomeres lengths and lengths of telomeres at individual chromosome arms …



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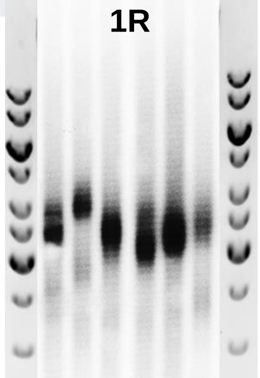
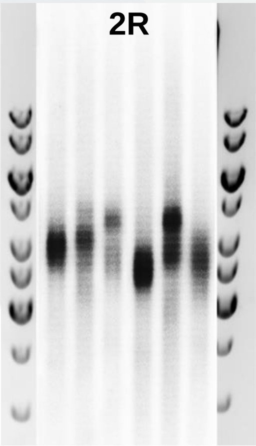
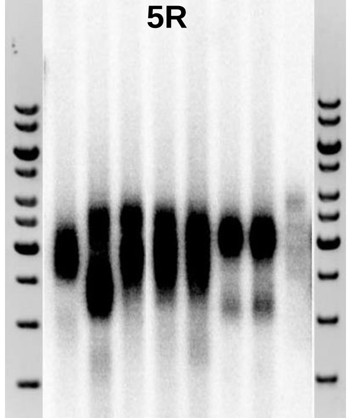
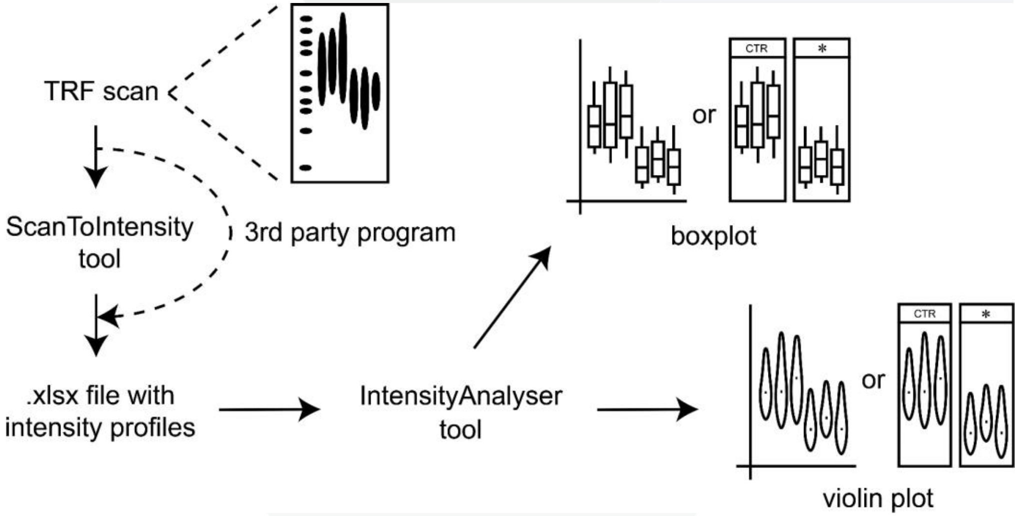






WALTER



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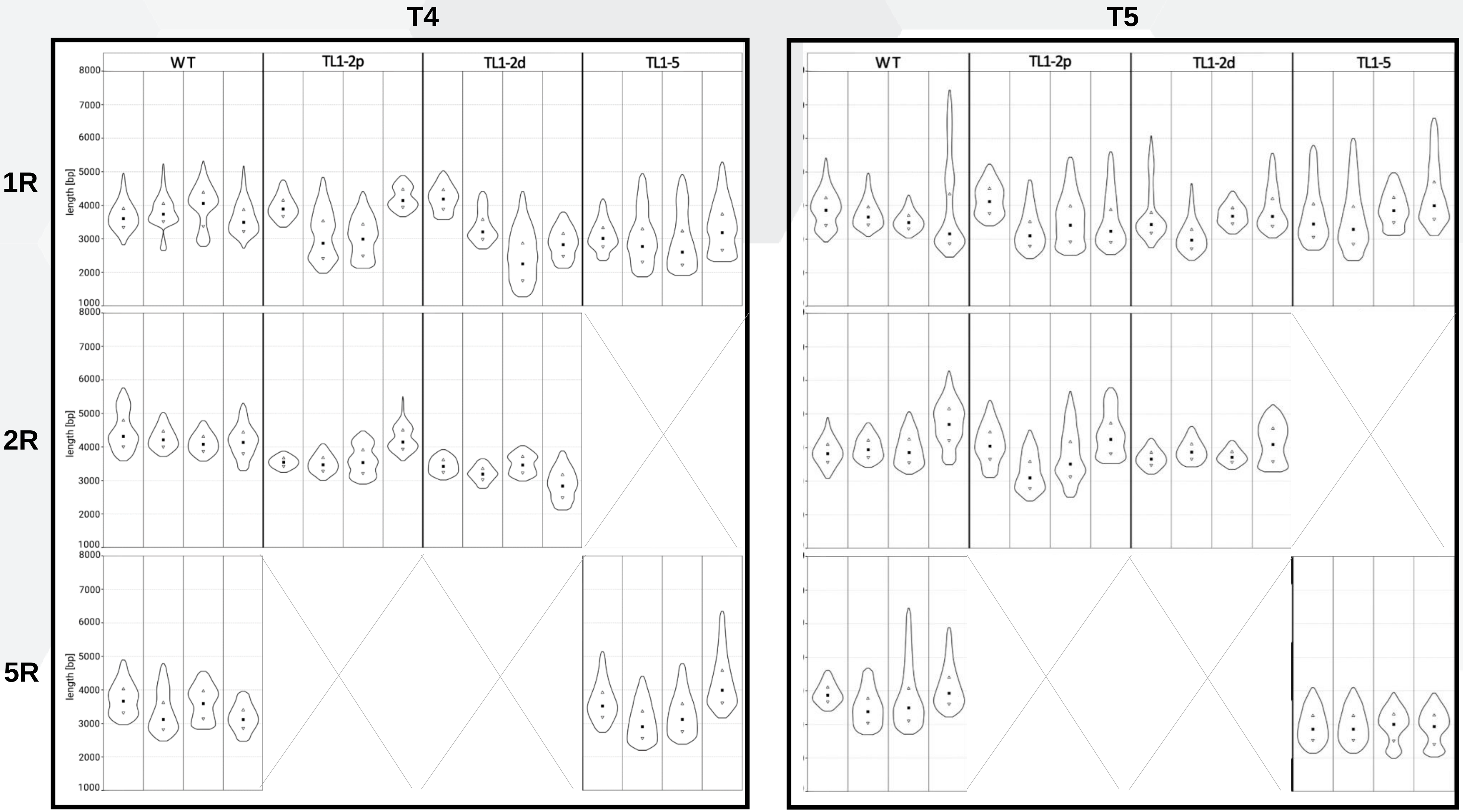
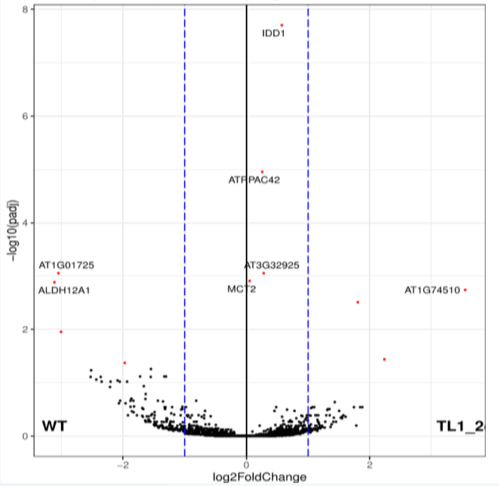
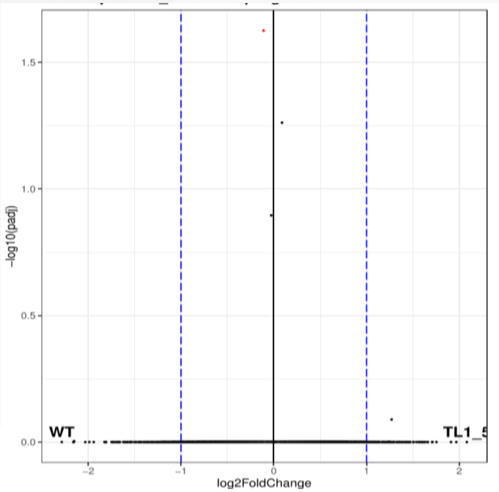
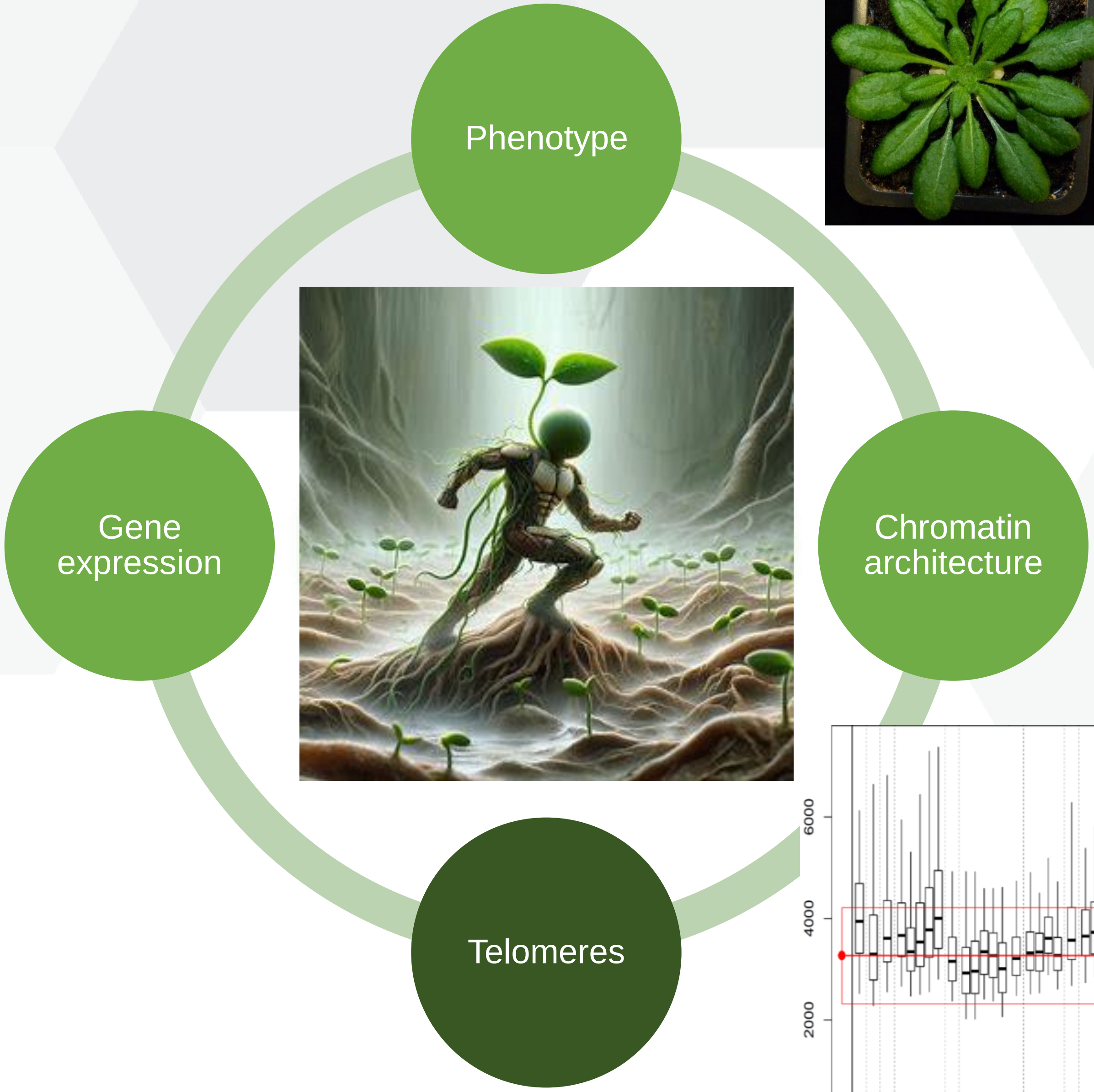
Bulk telomeres lengths and lengths of telomeres at individual chromosome arms are maintained

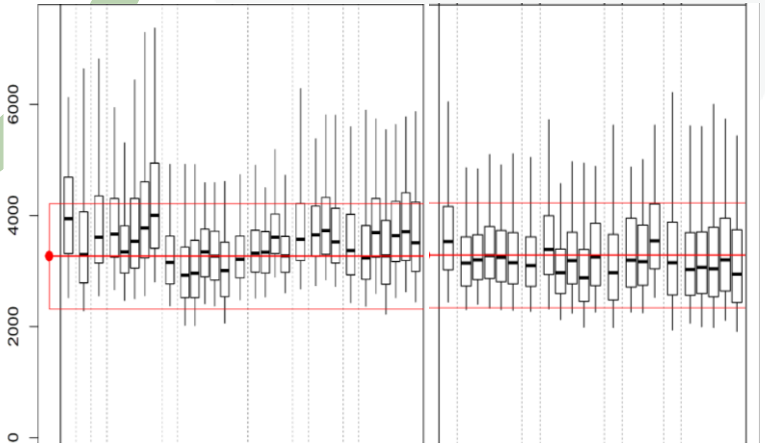


Phenotype of plants with restructured chromosomes maintained









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RG Chromatin Molecular Complexes CEITEC MU

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Thanks for your attention