



wtf: Killing gametes for more than 110 million years

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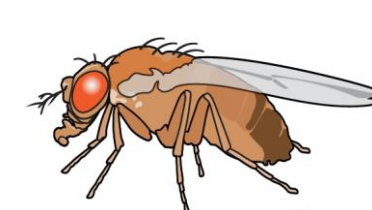
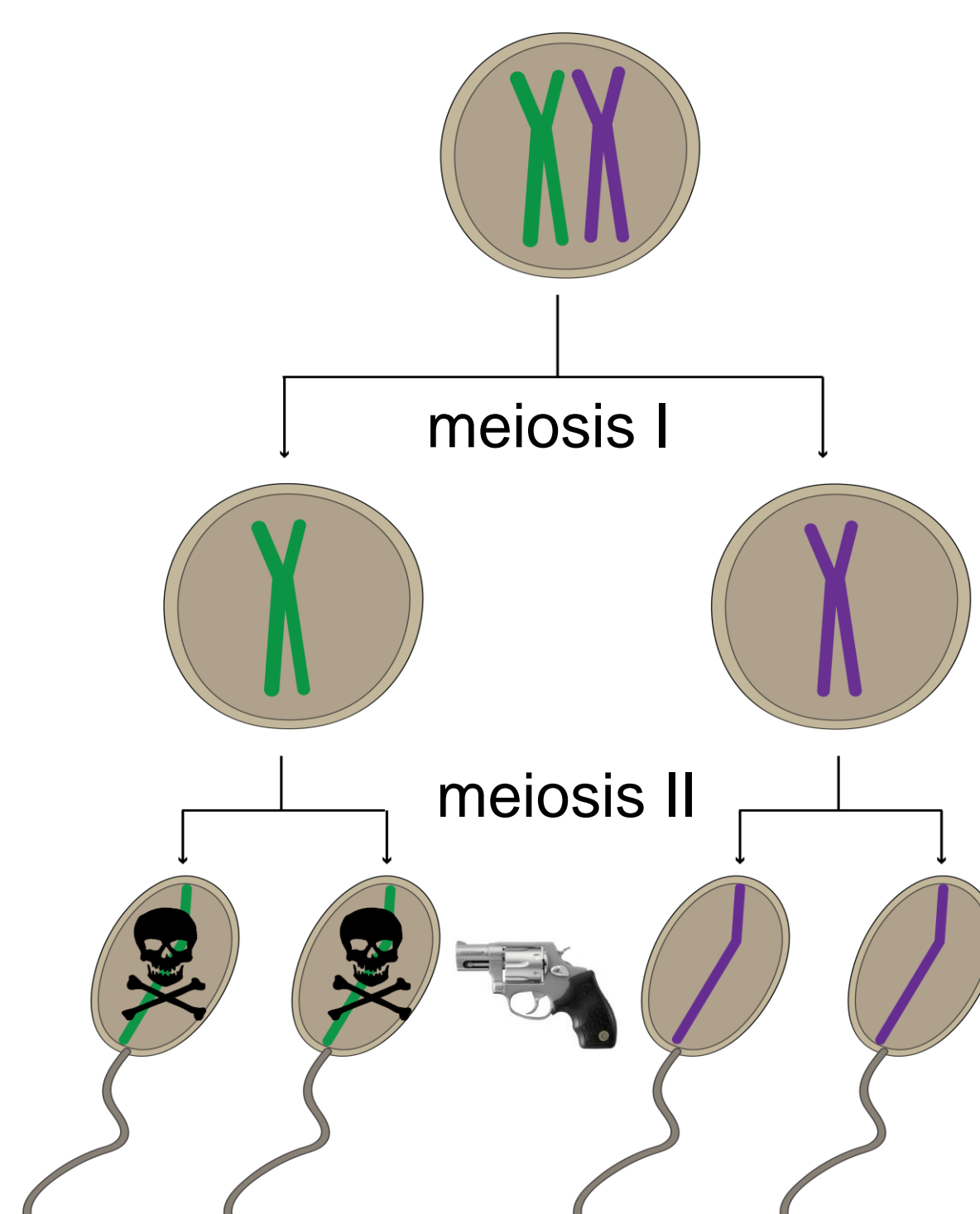


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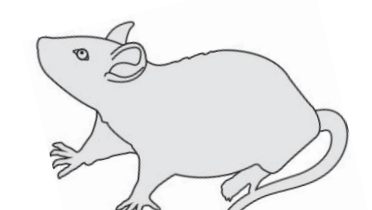
Meiotic drivers break Mendel's law of segregation

Meiotic drivers increase their own transmission into the next generation (up to 100%) :

- Can decrease fertility
- Are found throughout eukaryotes. For example



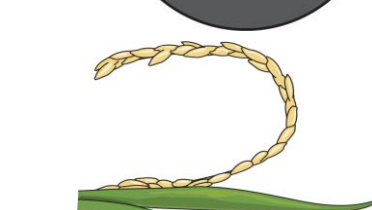
SD in *Drosophila melanogaster*



t-haplotype in *Mus musculus*

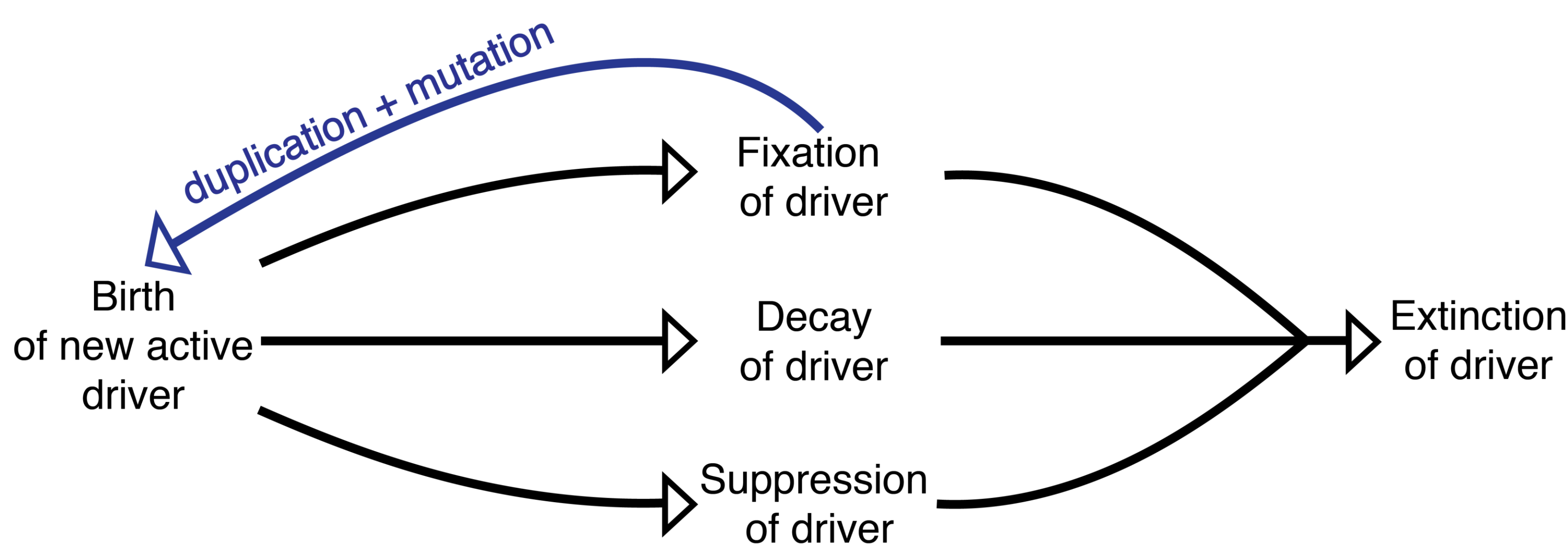


Spok in *Podospira anserina*



Sa in *Oryza sativa* (rice)

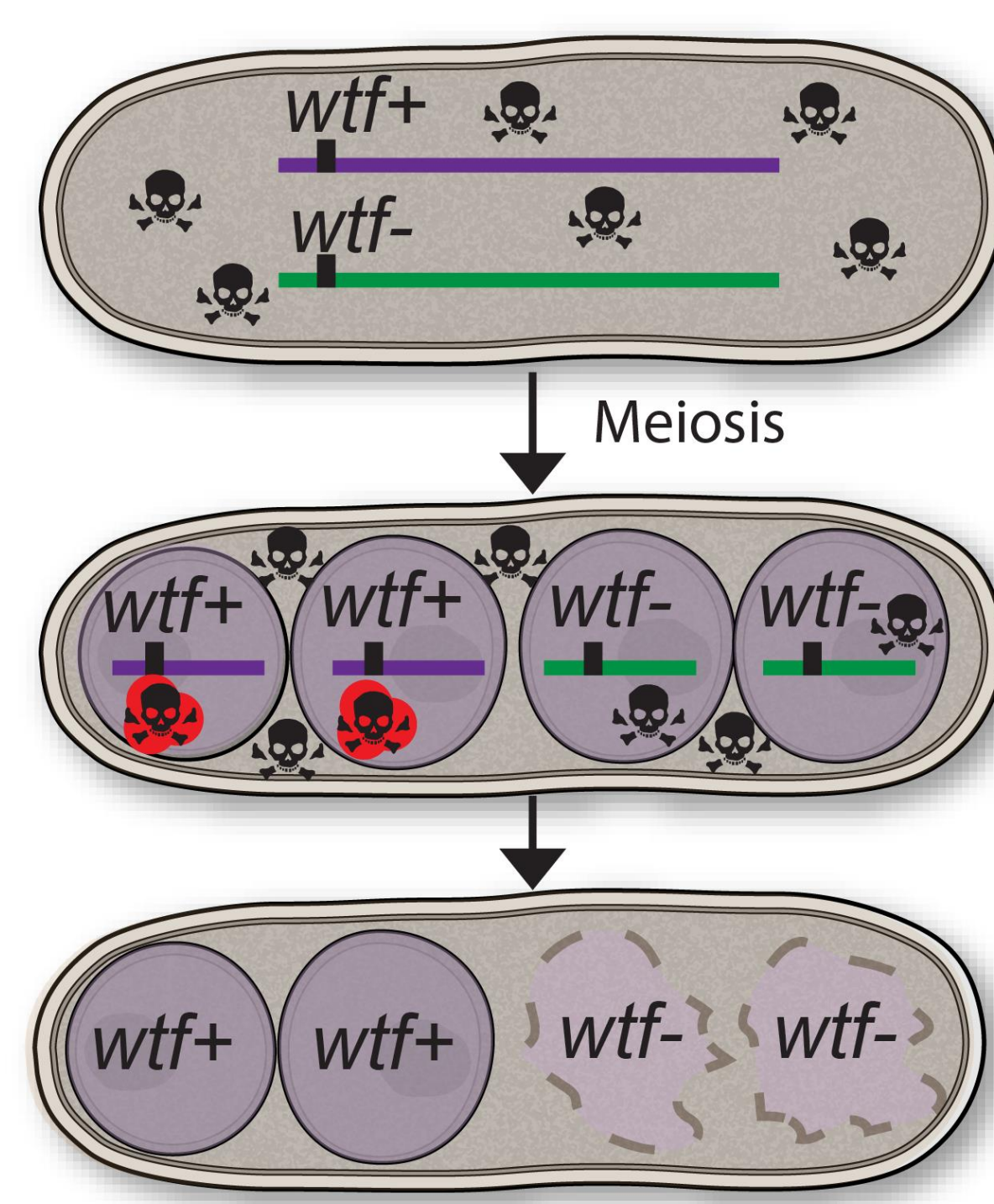
Model for meiotic drive evolution



- Meiotic drivers are predicted to have a short evolutionary lifespan

Hypothesis: Duplication events and mutation could allow meiotic drivers to persist

wtf gene are meiotic drivers in *Schizosaccharomyces pombe*



antidote • *wtf* (*with transposon fission yeast*)



poison • One gene encodes two proteins

• poison spreads to all gametes

• antidote is gamete-specific

• drive facilitates spread of *wtf* alleles in a population

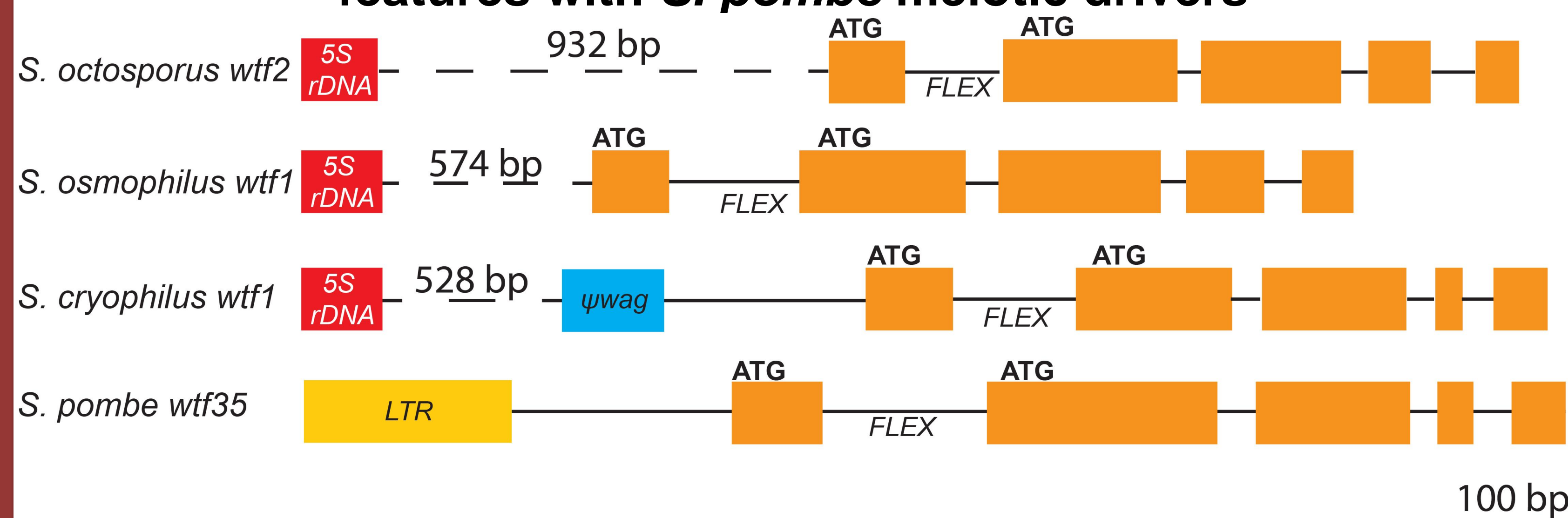


dead gamete

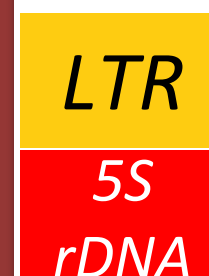
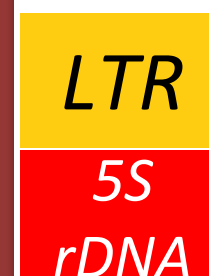


viable gamete

S. octosporus, *S. osmophilus* and *S. cryophilus* wtf genes share features with *S. pombe* meiotic drivers



FLEX = Binding site of transcription factor Mei4 that controls poison transcription



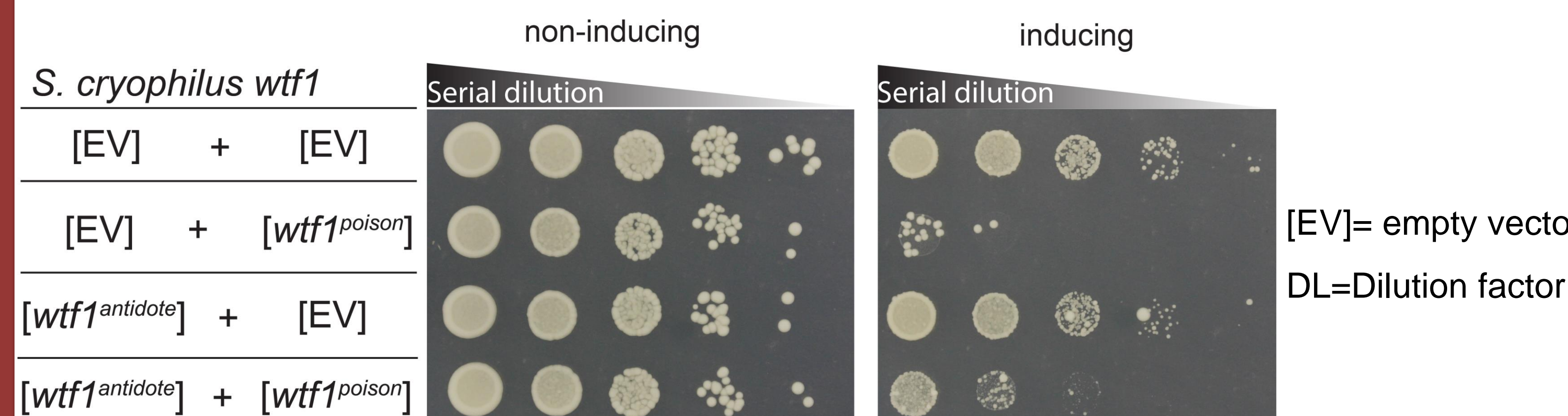
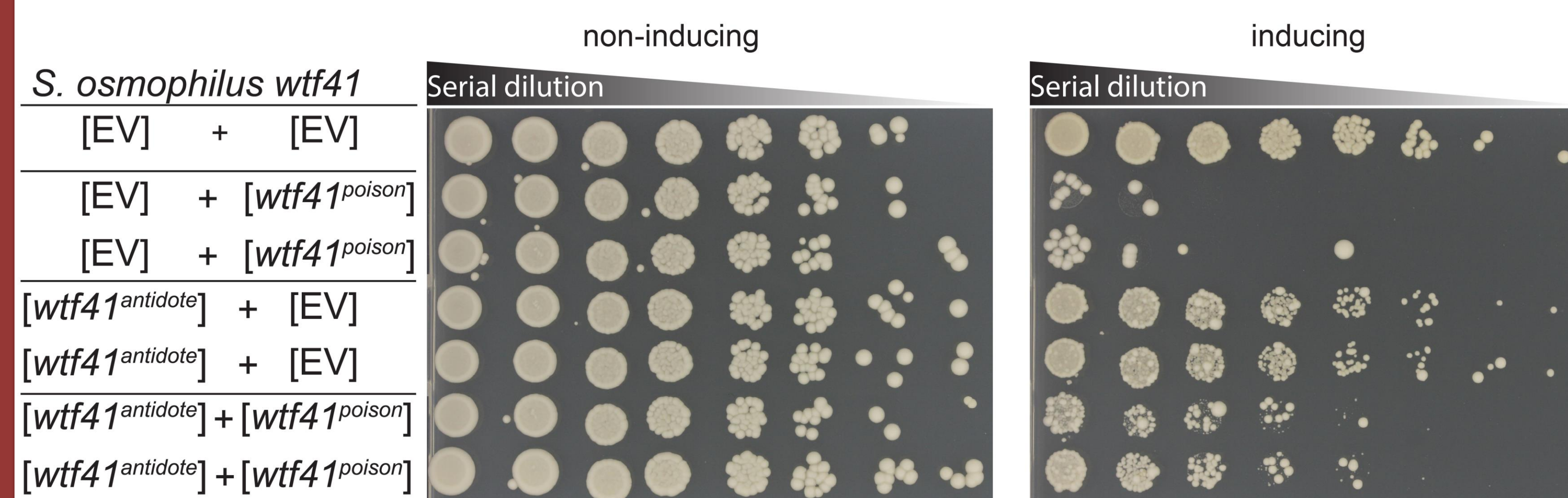
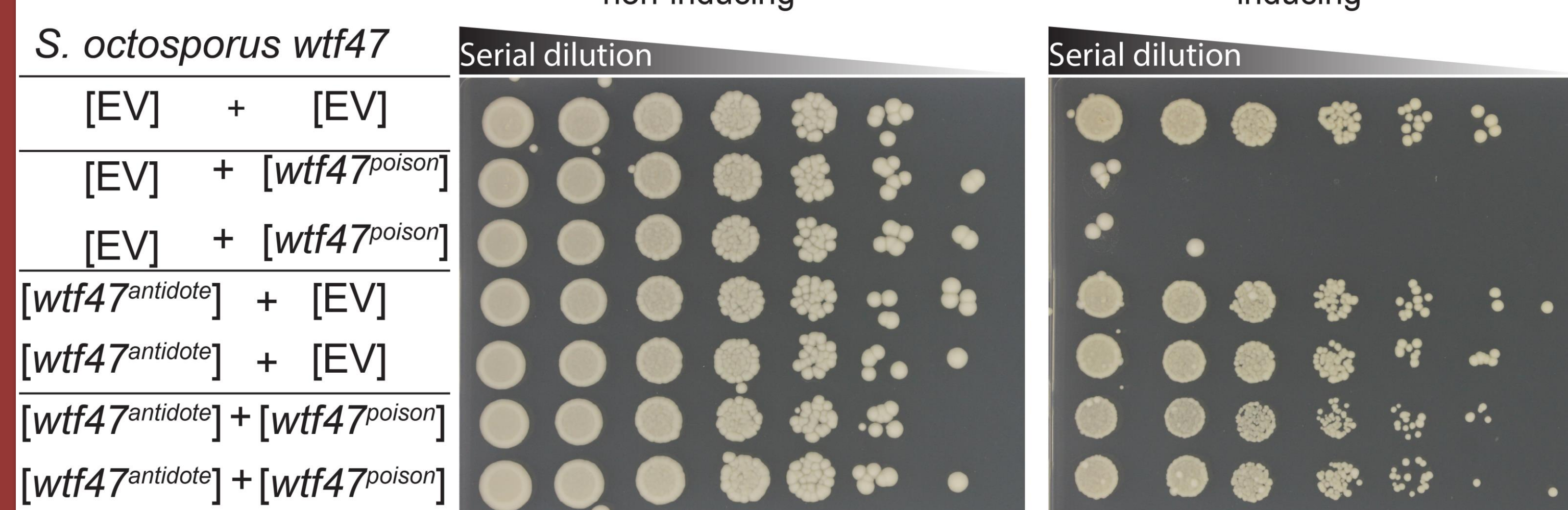
dispersed repetitive sequences



pseudogene wtf associated gene

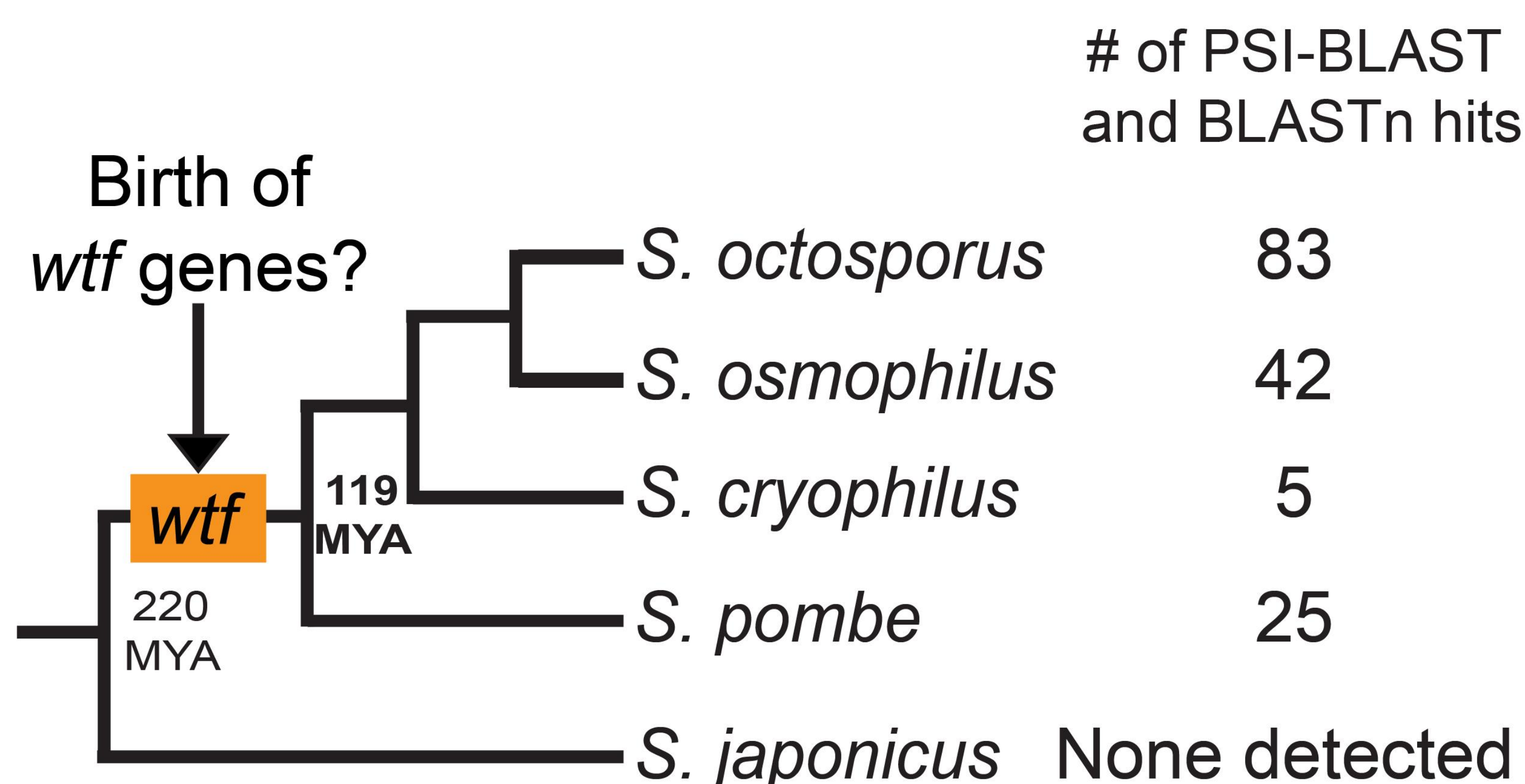
wtf genes encode poison and antidote proteins

Testing ability of *S. octosporus*, *S. osmophilus* and *S. cryophilus* wtf genes to encode poison and antidote proteins by expressing them in budding yeast.



[EV]= empty vector
DL=Dilution factor

Analysis suggests wtf genes are 110 million years old



Conclusions

- *wtf* genes are present in *S. octosporus*, *S. osmophilus*, *S. cryophilus* and *S. pombe*
- *wtf* genes are associated with dispersed repetitive sequences which may allow them to duplicate in the genome by gene conversion
- *wtf* genes of the four species encode poison and antidote proteins
- *S. octosporus* wtf gene meiotic drive at its endogenous locus when heterozygote (Guo Song Jia from Li-Lin Du lab data not shown)
- *wtf* genes have been meiotic drivers for at least **110 million years**

This project is in collaboration with Guo Song Jia and Li-Lin Du.

References: Nuckolls and Bravo Núñez et al. (2017); Hu et al. (2017), Rhind et al. (2011)

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