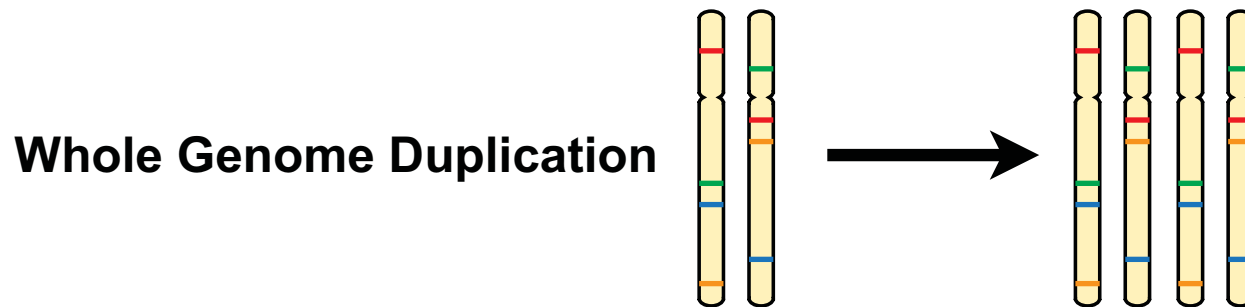
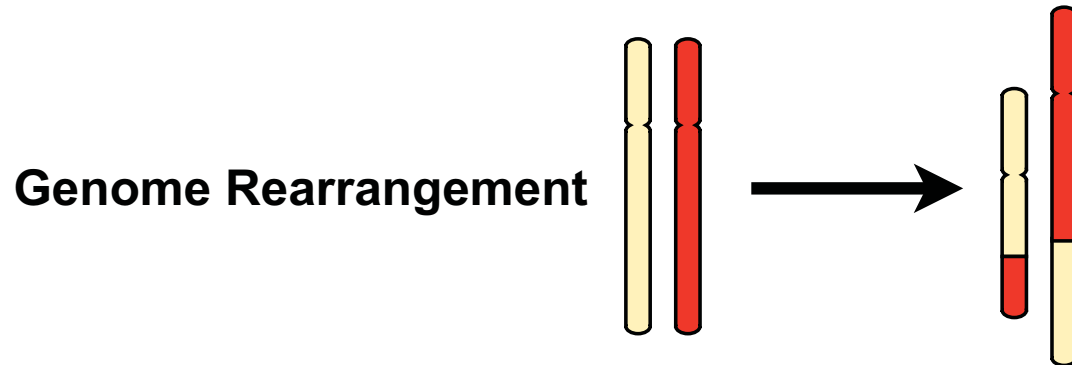
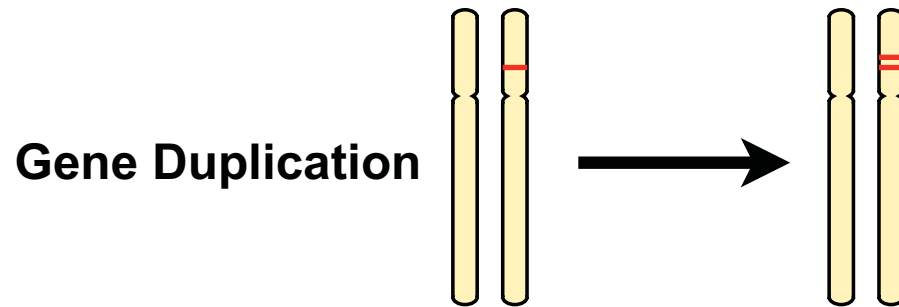


# Genome Evolution

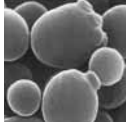








**Greg Lang, Department of Biological Sciences**

BioS 010: Bioscience in the 21st Century

# Mechanisms of genome evolution

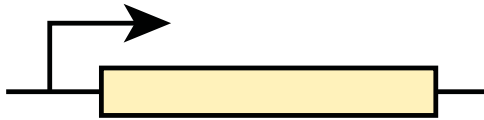
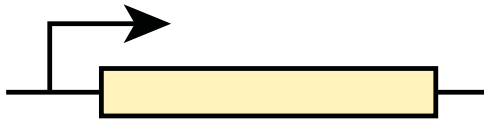


# Gene number varies between species

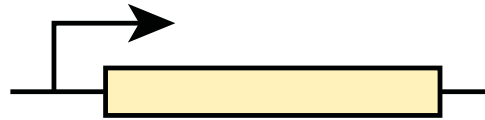
	Species	Gene #
<i>Saccharomyces cerevisiae</i>		6,294
<i>Neurospora crassa</i>		10,082
<i>Drosophila melanogaster</i>		13,600
<i>Caenorhabditis elegans</i>		19,000
<i>Homo sapiens</i>		20,251
<i>Takifugu rubripes</i>		22-29,000
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<i>Oryza sativa</i>		32-50,000
<i>Populus trichocarpa</i>		45,555

# Fates of duplicated genes

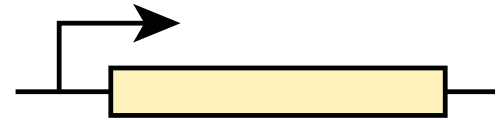
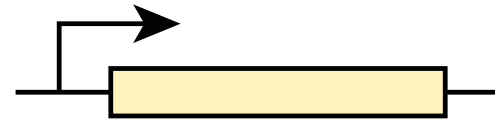
**Dosage**



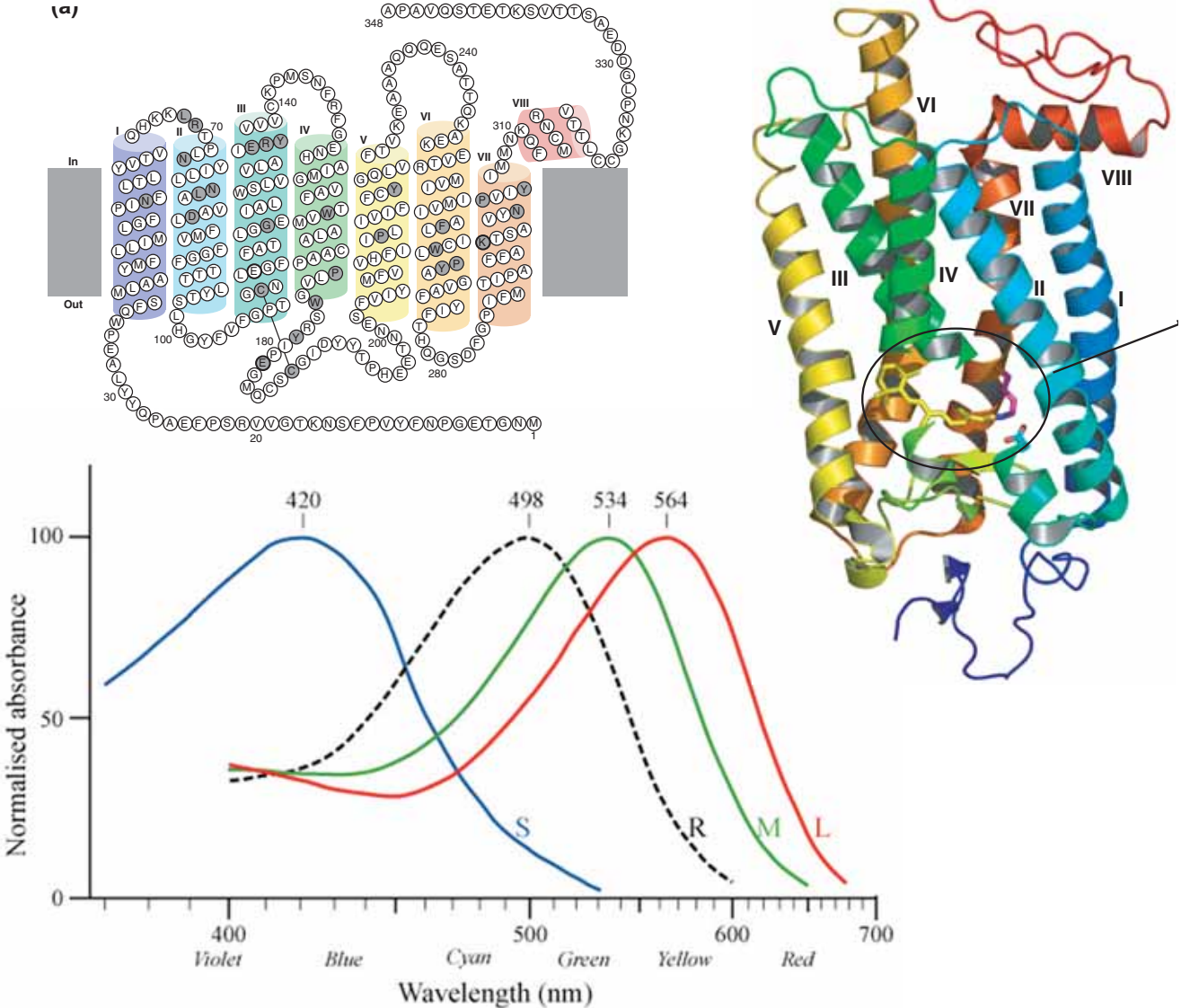
**Subfunctionalization**



**Neofunctionalization**

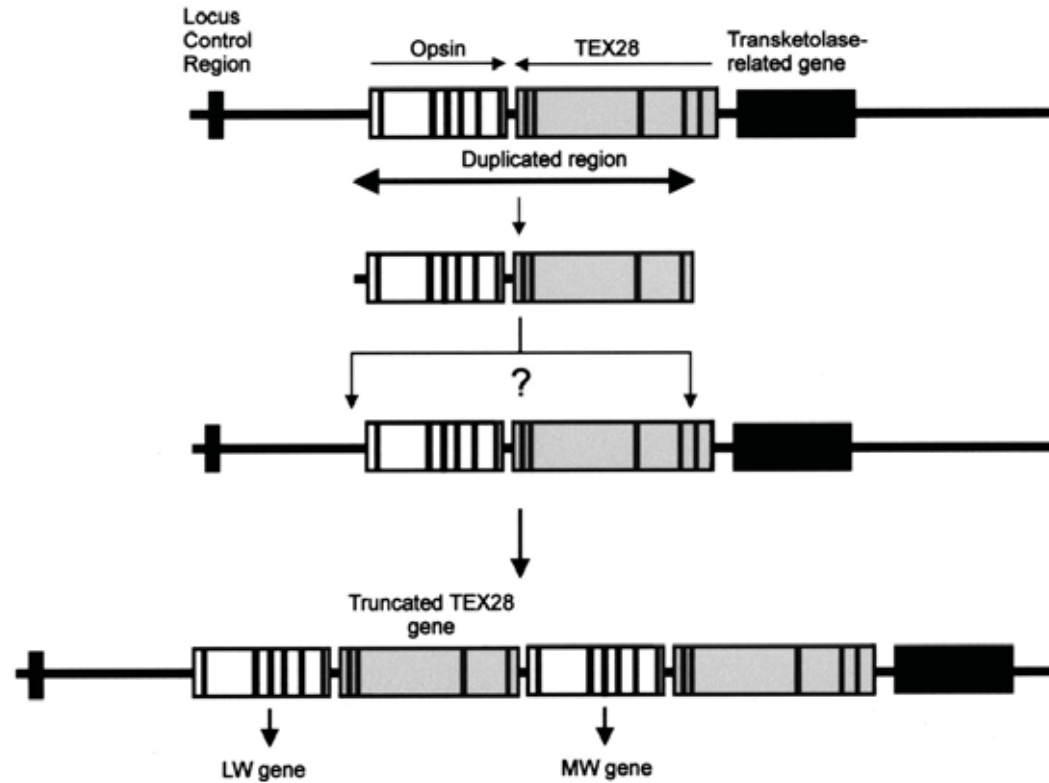


# Human opsin genes and trichromatic vision

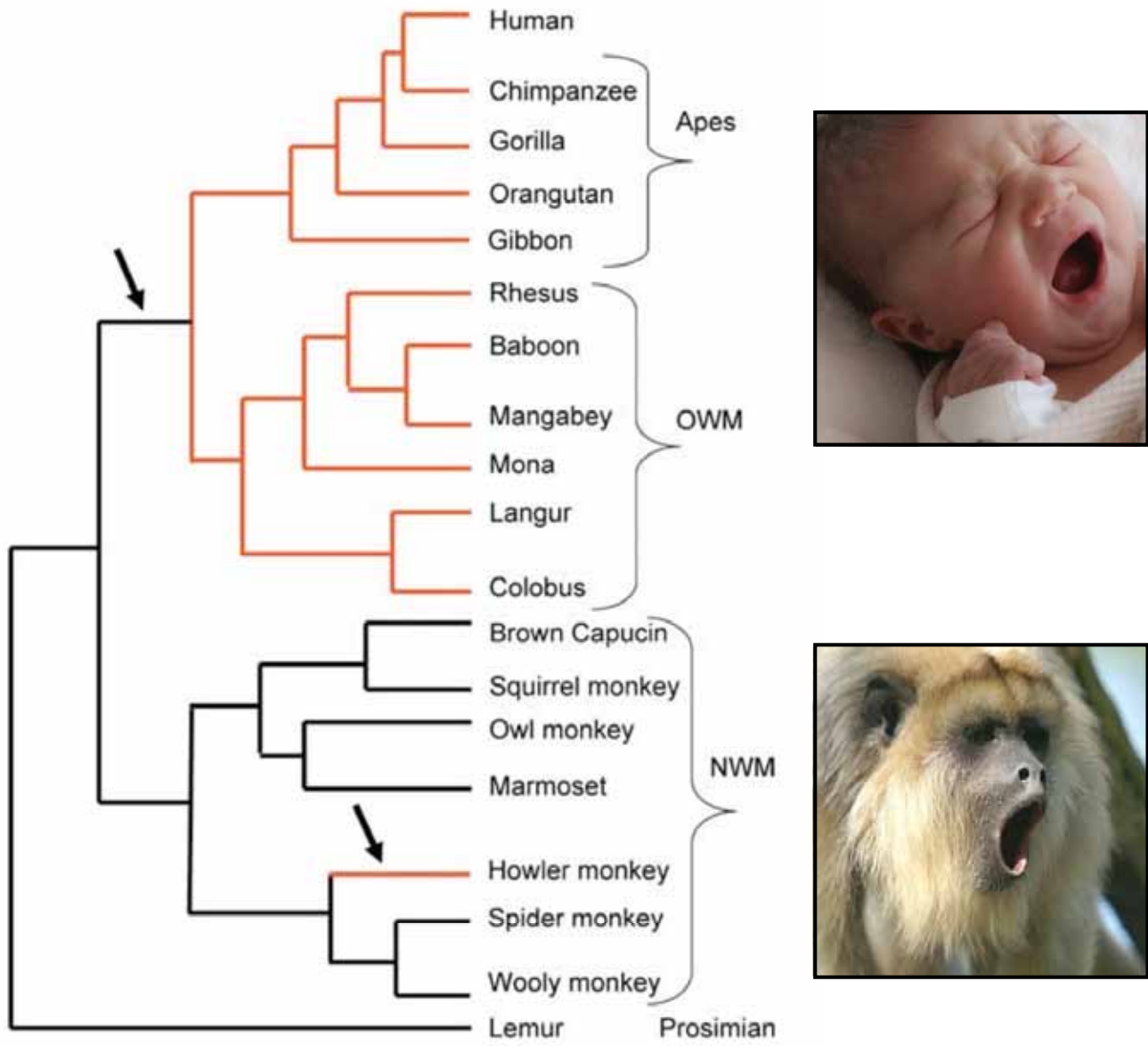


Terakita. Genome Biol. 2005;6(3):213.

# Duplication of opsin genes in old-world primates

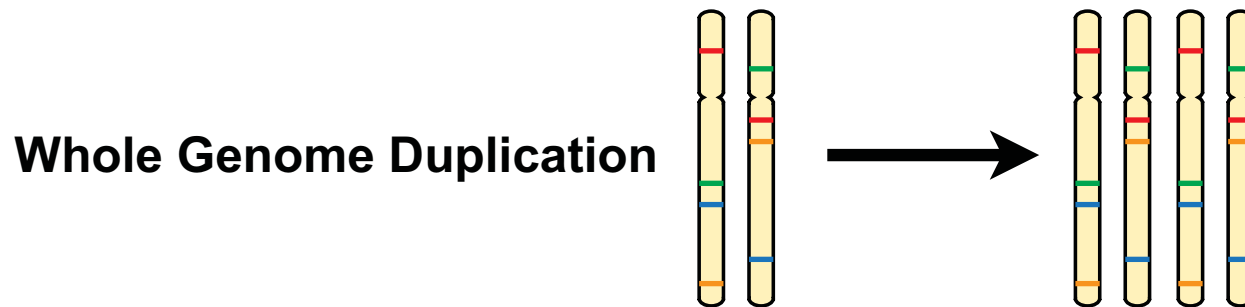
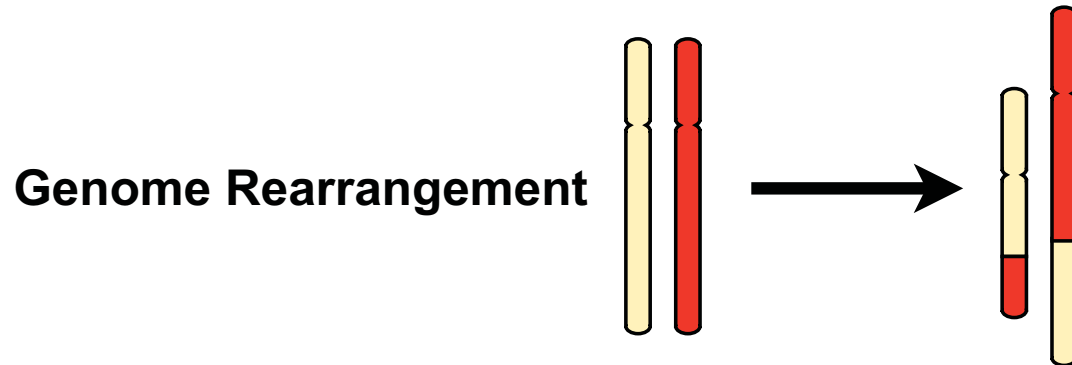
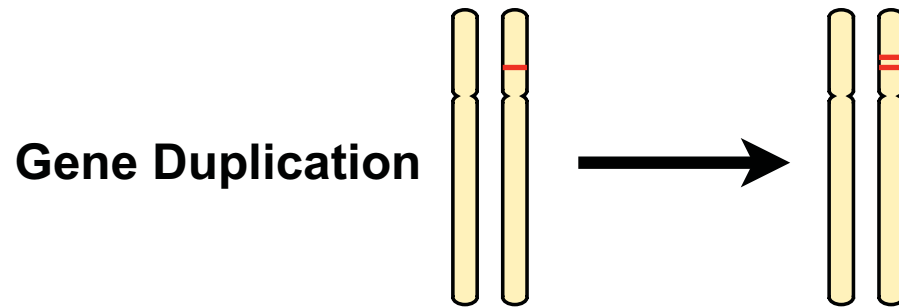


# Trichromatic vision in howler monkeys



Gilad et al. PLoS Biol. 2004 Jan;2(1):E5.

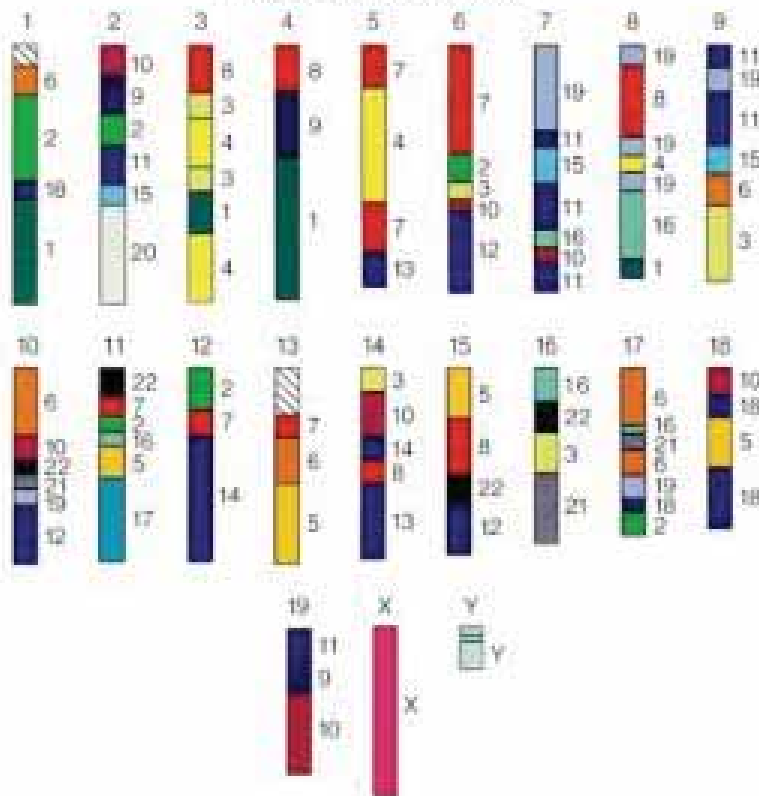
# Mechanisms of genome evolution



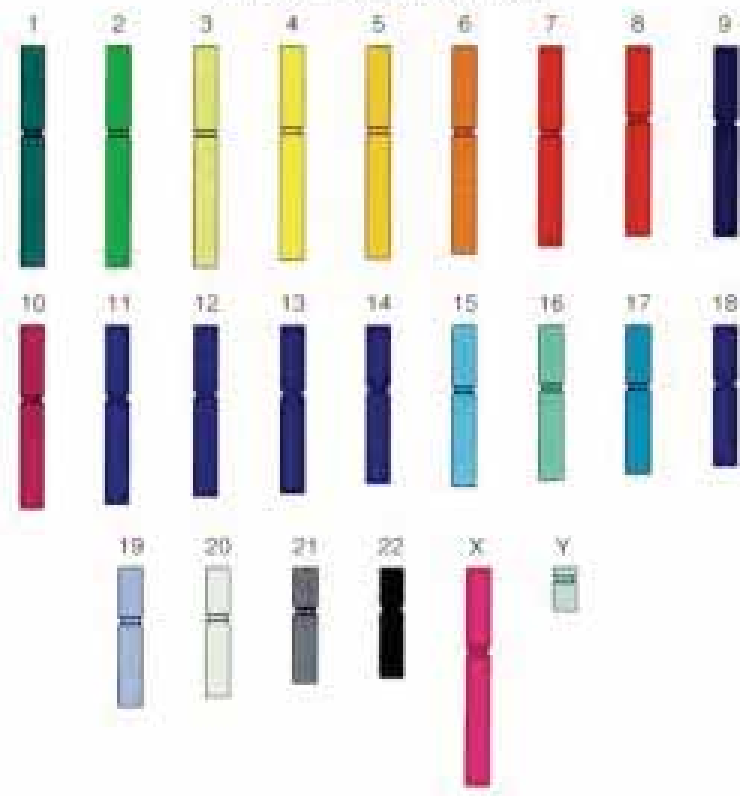


# Genomes rearrange during evolution

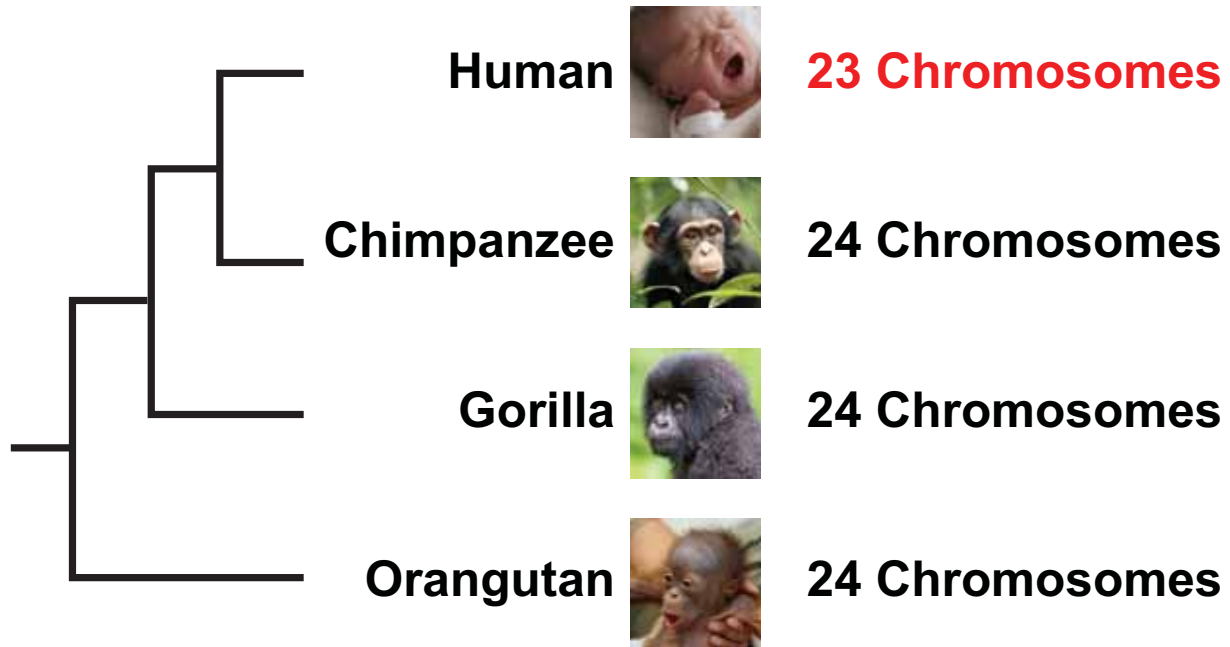
**Mouse Genome**



**Human Genome**



# The “missing” human chromosome

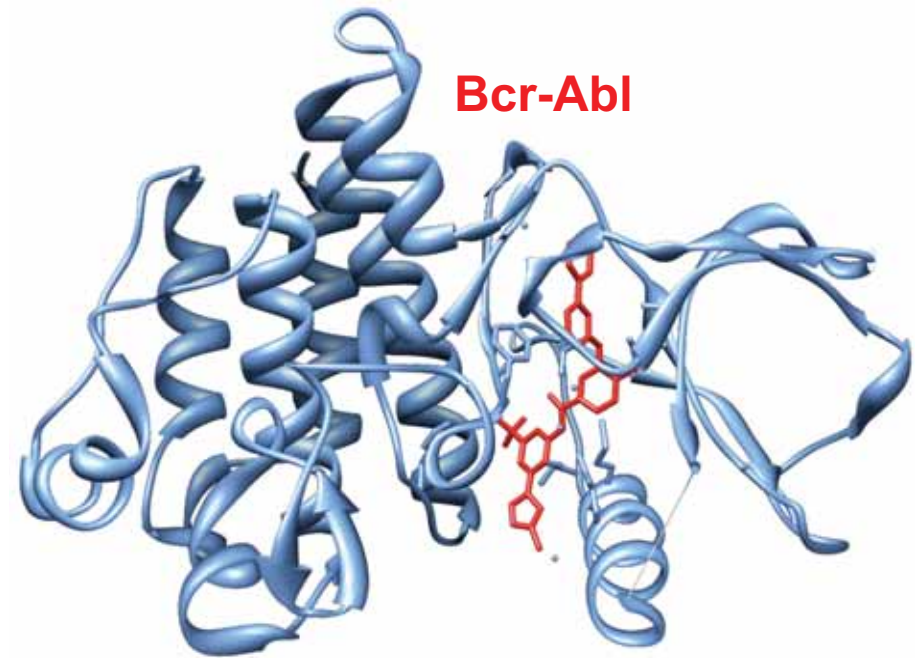
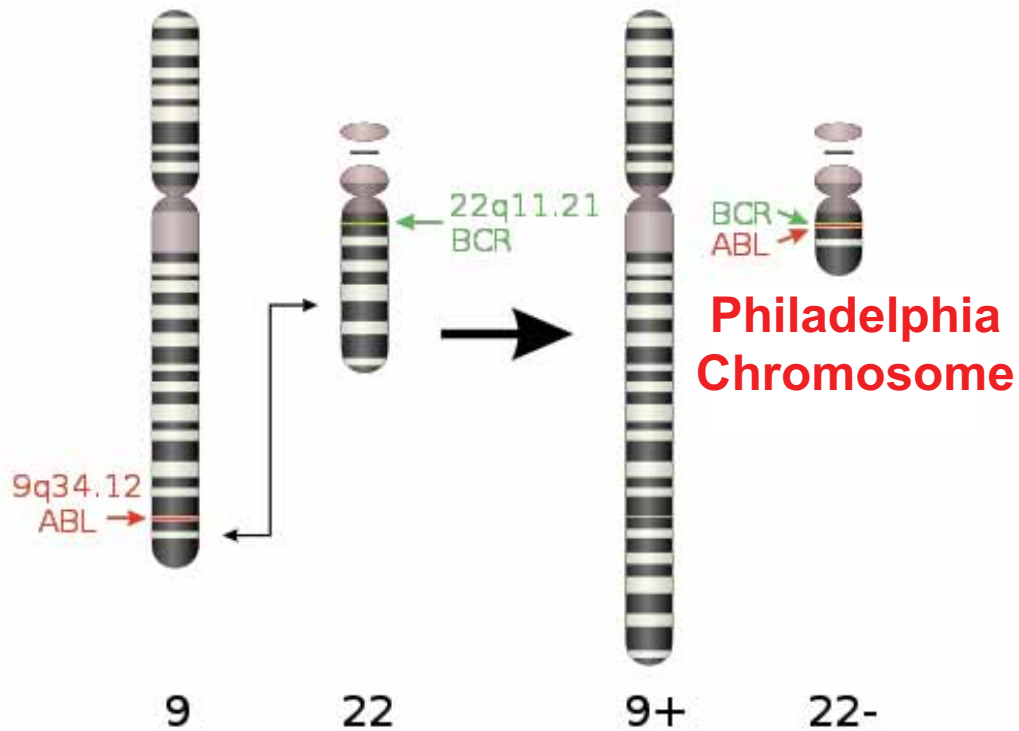


# Human Chromosome 2 arose through fusion

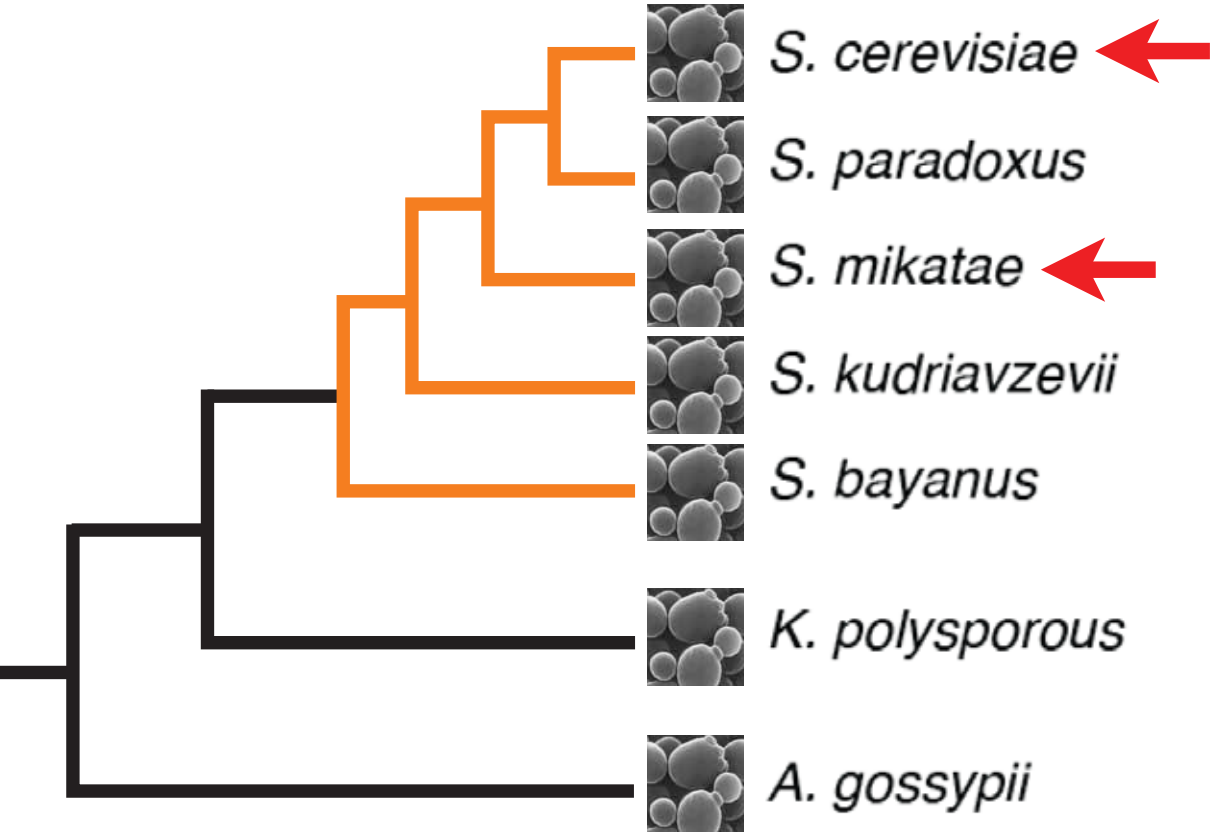


Yunis and Prakash. Science. 1982 Mar 19;215(4539):1525-30.

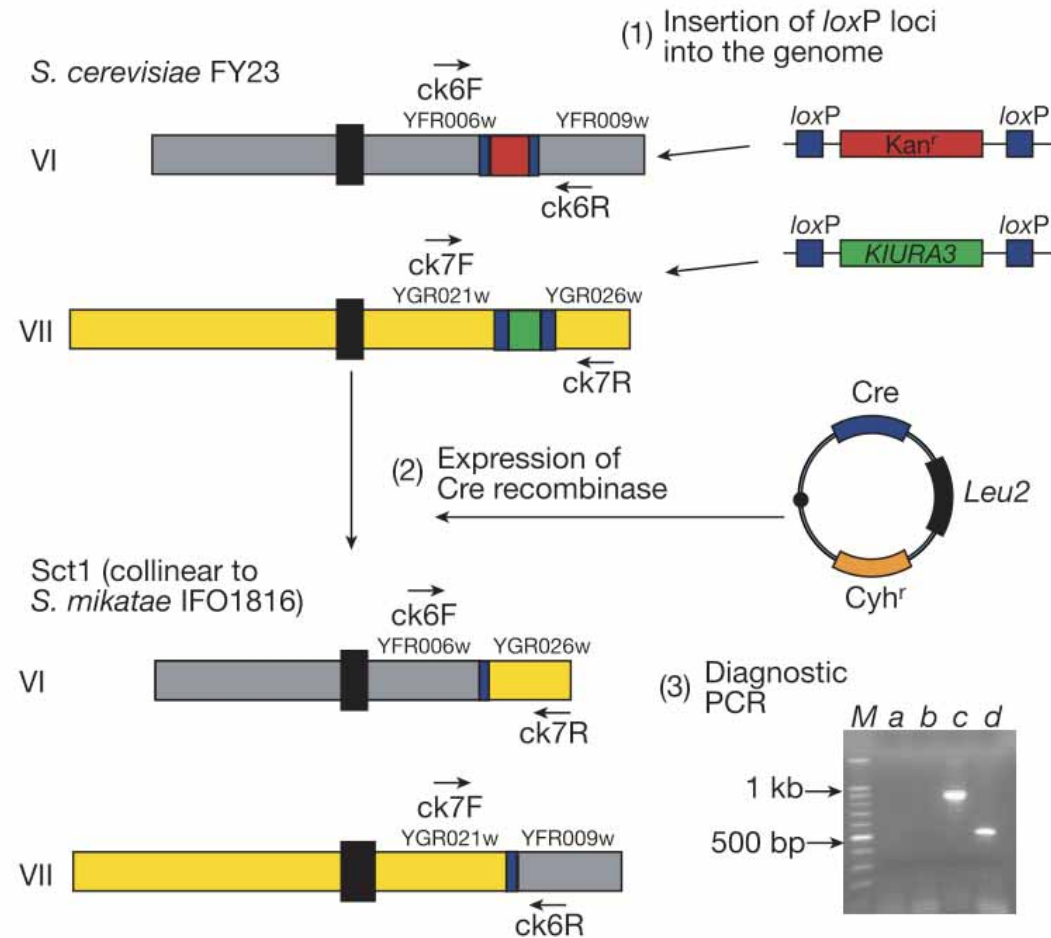
# Genome rearrangement in cancer



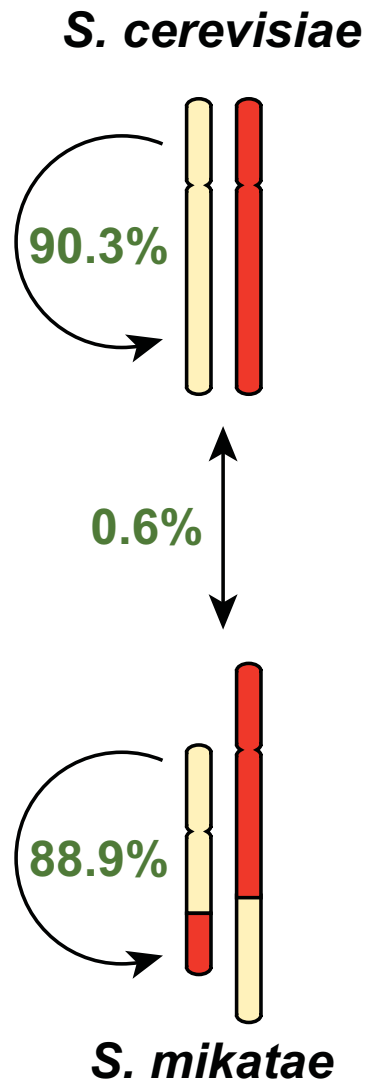
# Genome rearrangements as a genetic barrier



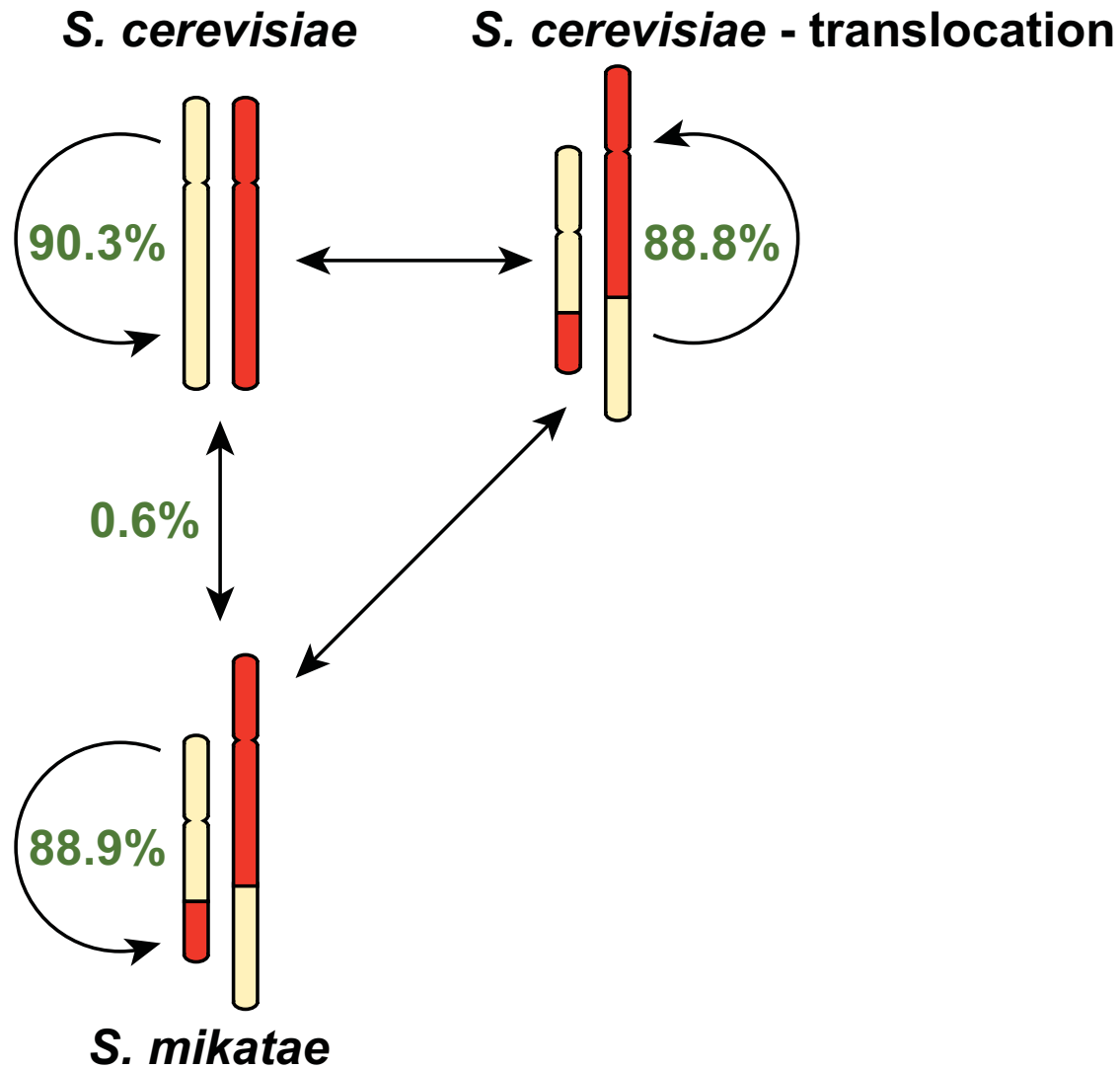
# Engineering evolution to study speciation in yeast



# Engineering evolution to study speciation in yeast

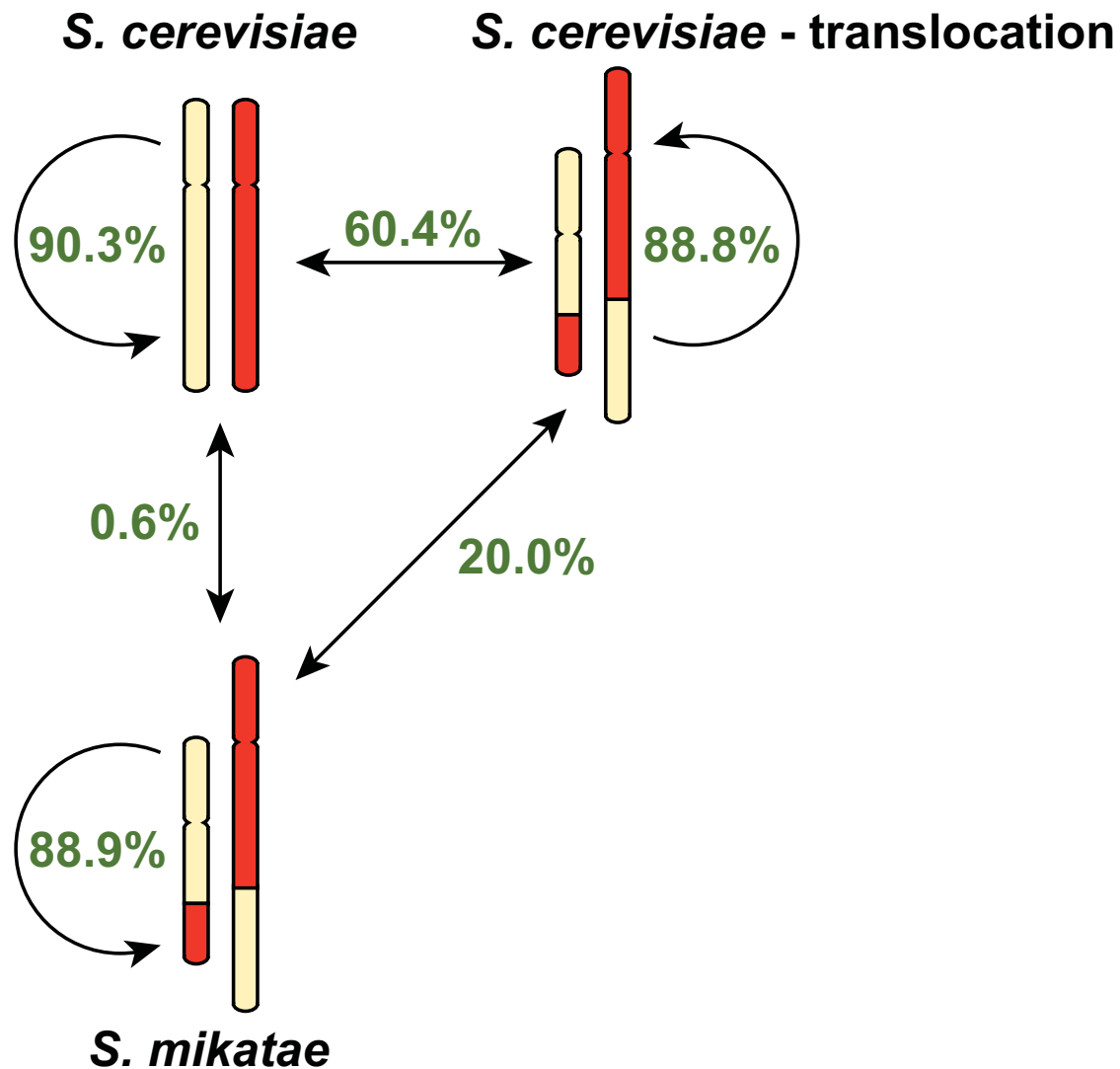


# Engineering evolution to study speciation in yeast

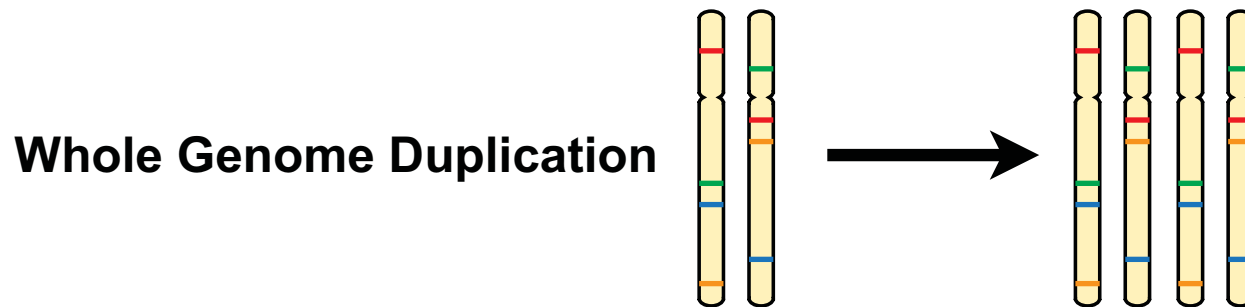
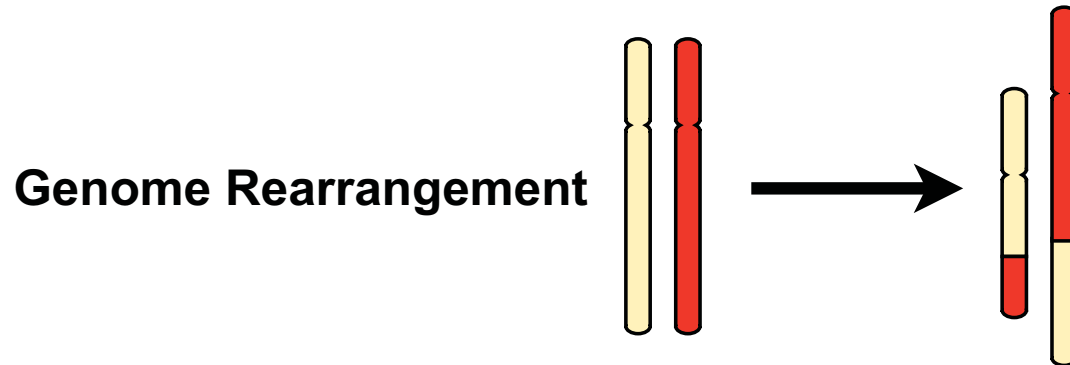
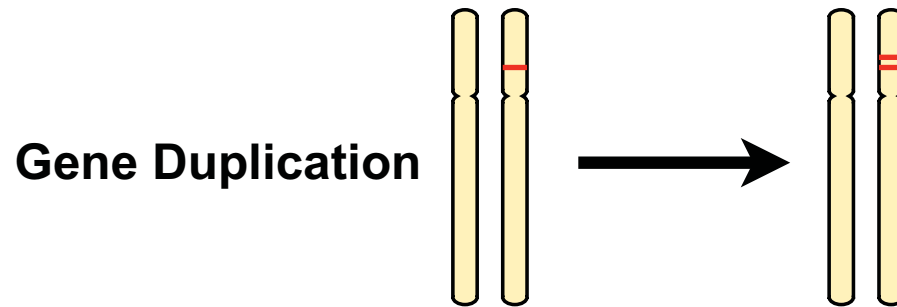




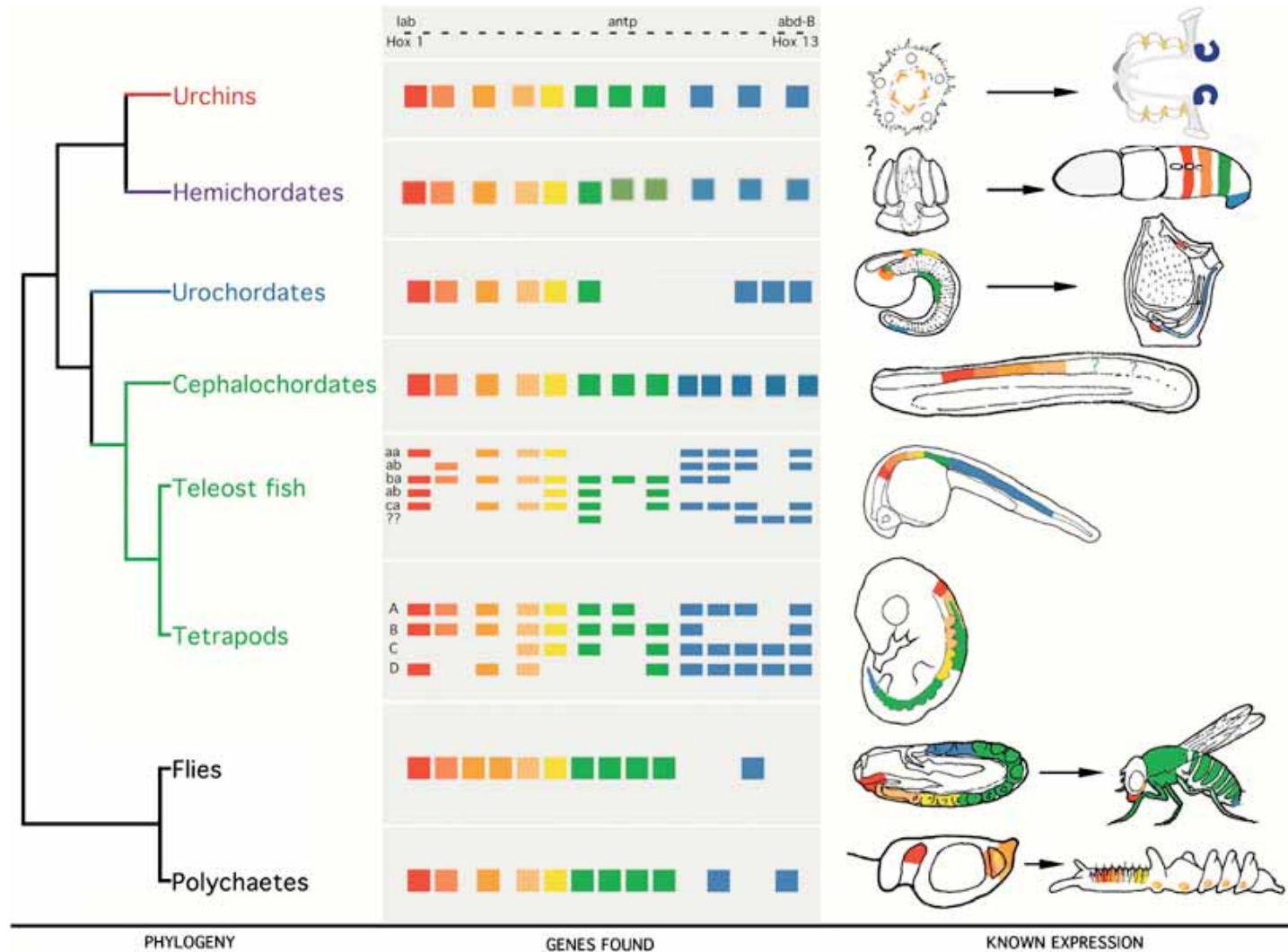
# Engineering evolution to study speciation in yeast



# Mechanisms of genome evolution

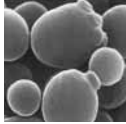










# Evidence of two WGDs in vertebrate Hox clusters

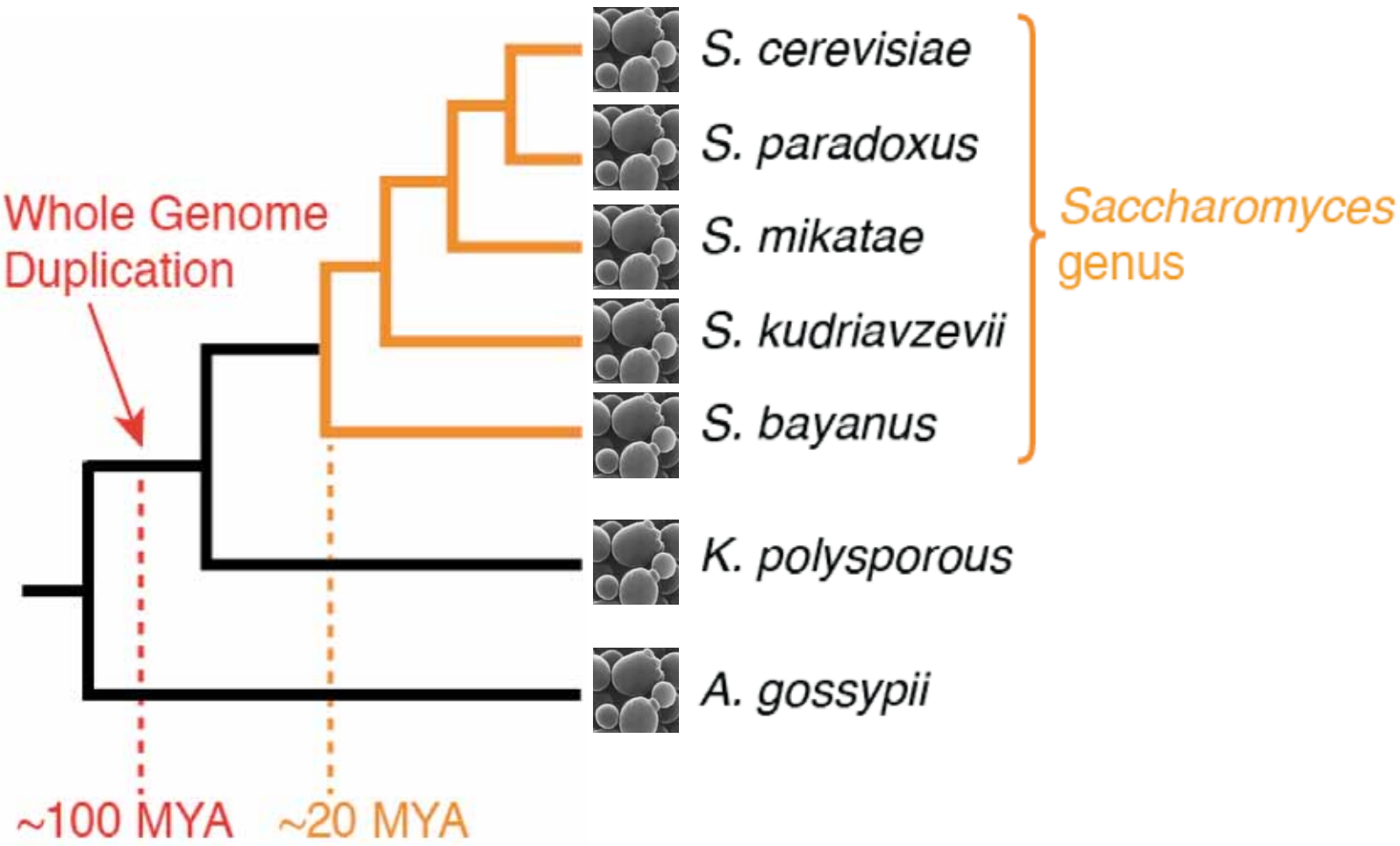


Swalla. Heredity. 2006 Sep;97(3):235-43.

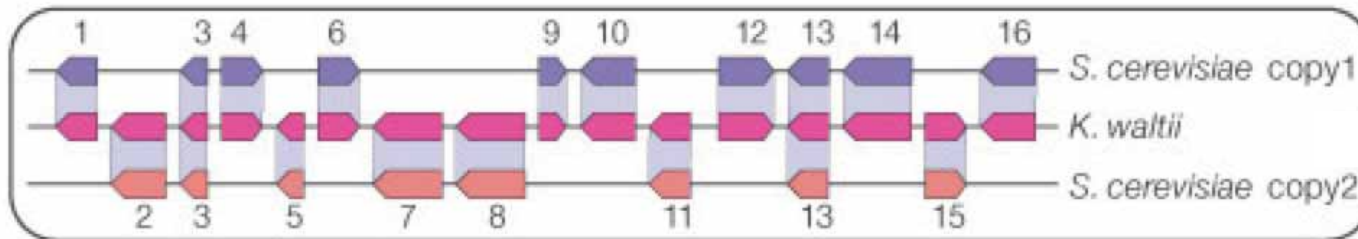
# Gene number varies between species

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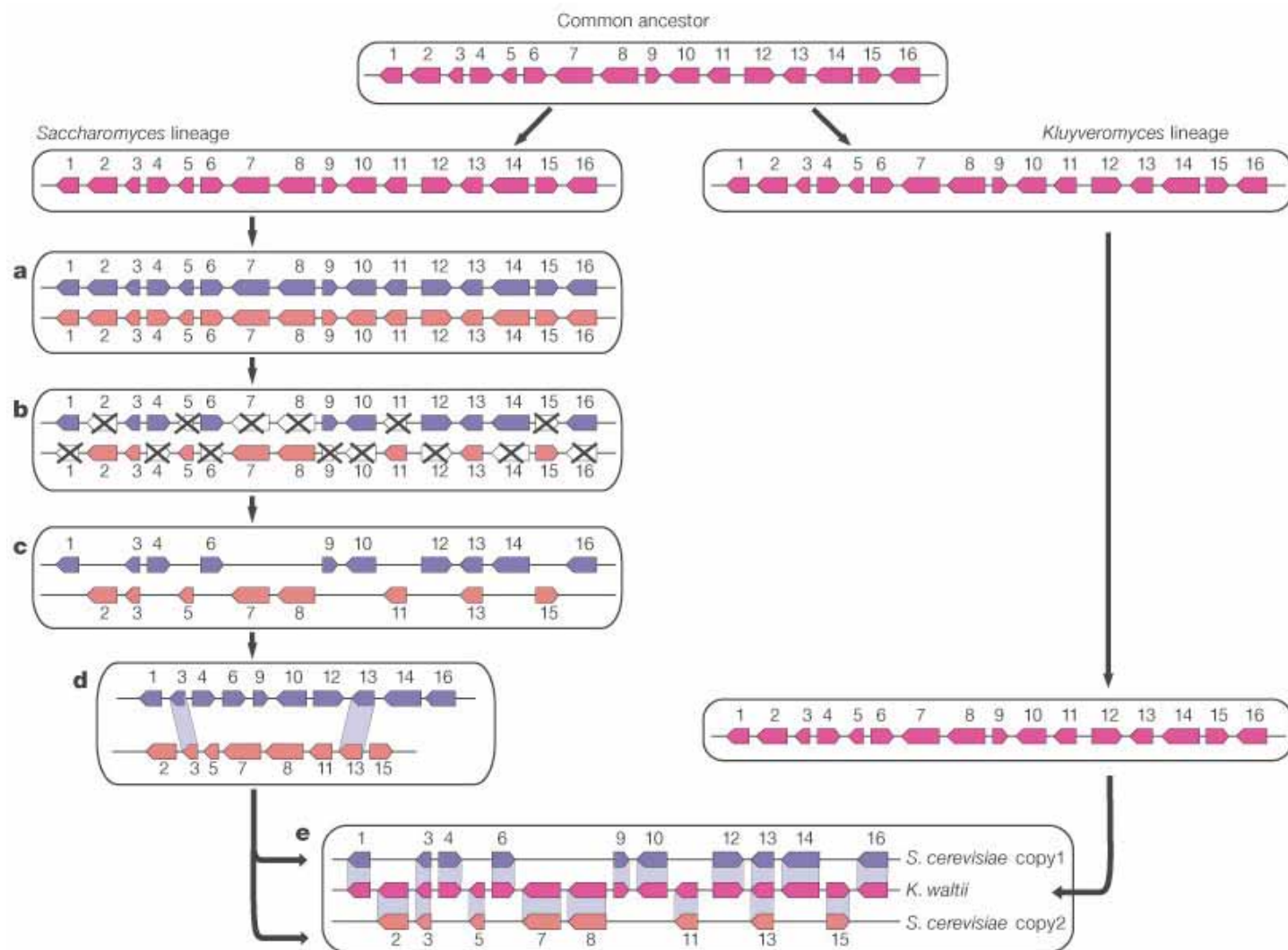
# Genome rearrangements as a genetic barrier



# Evidence for a whole-genome duplication in yeast

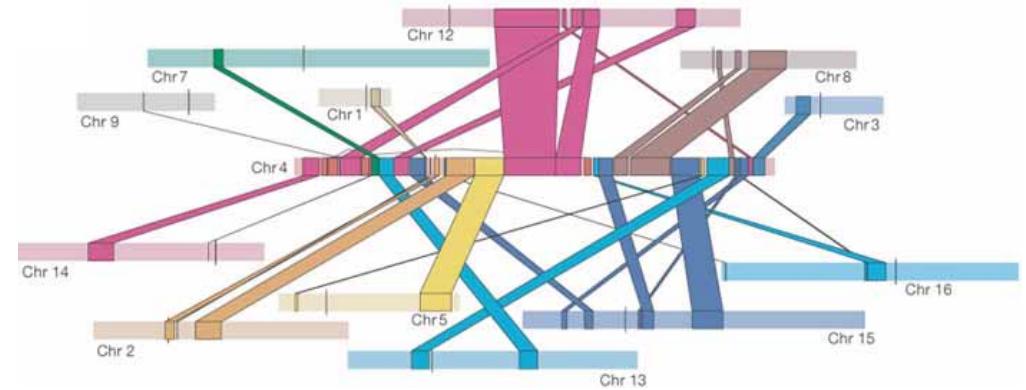


# Evidence for a whole-genome duplication in yeast



Kellis et al. Nature. 2004 Apr 8;428(6983):617-24.

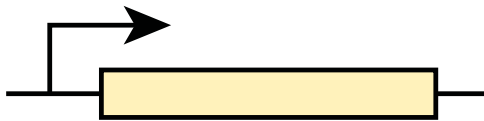
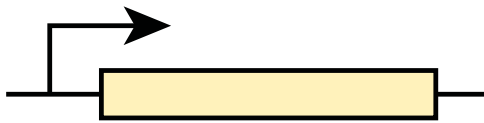
# Analysis of the whole-genome duplication in yeast



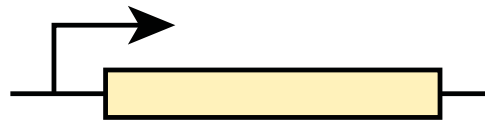


# Fates of duplicated genes

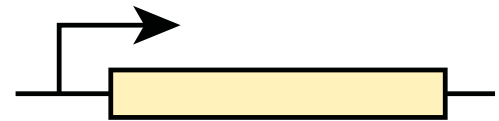
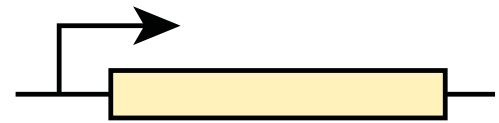
**Dosage**



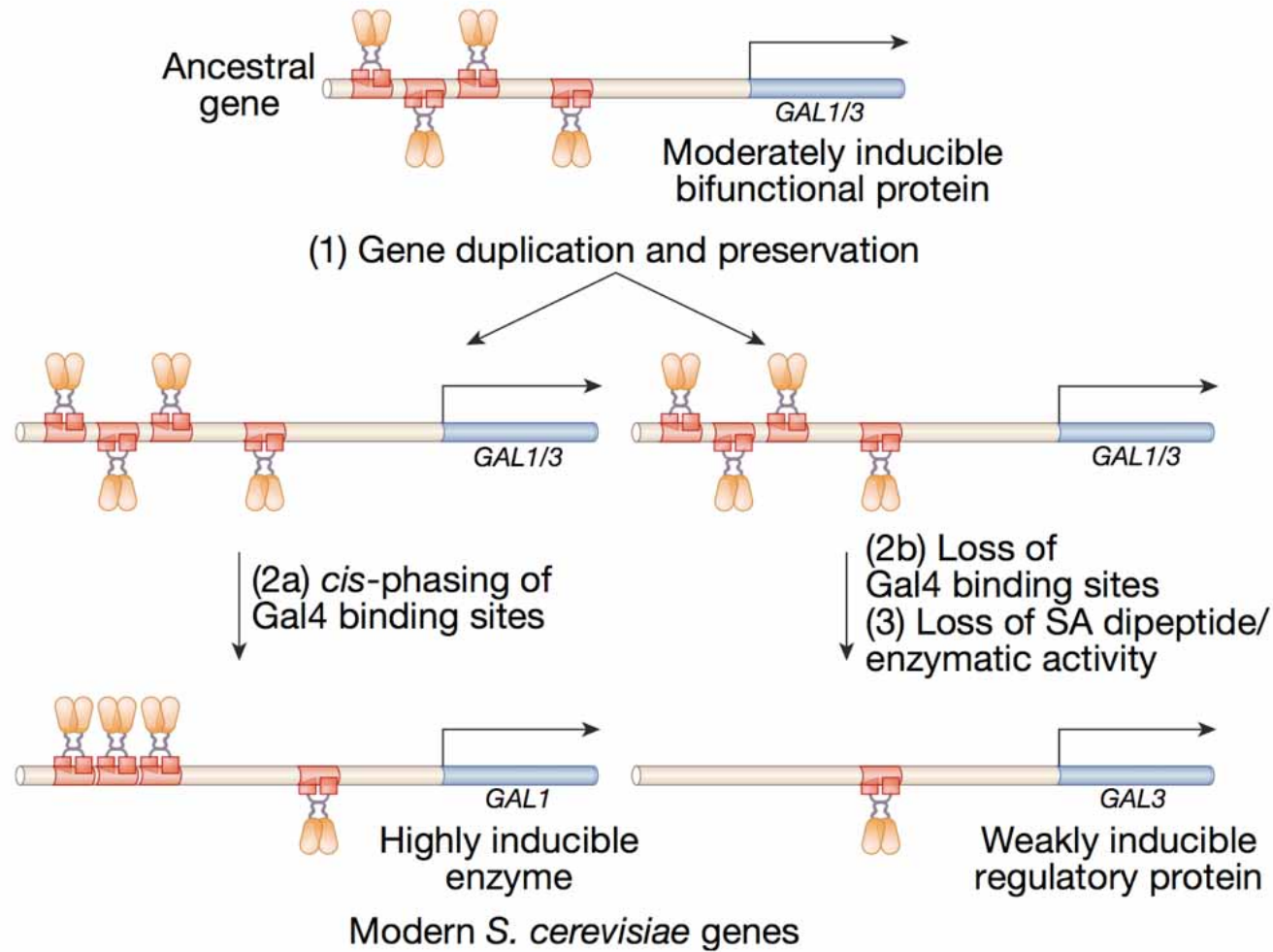
**Subfunctionalization**



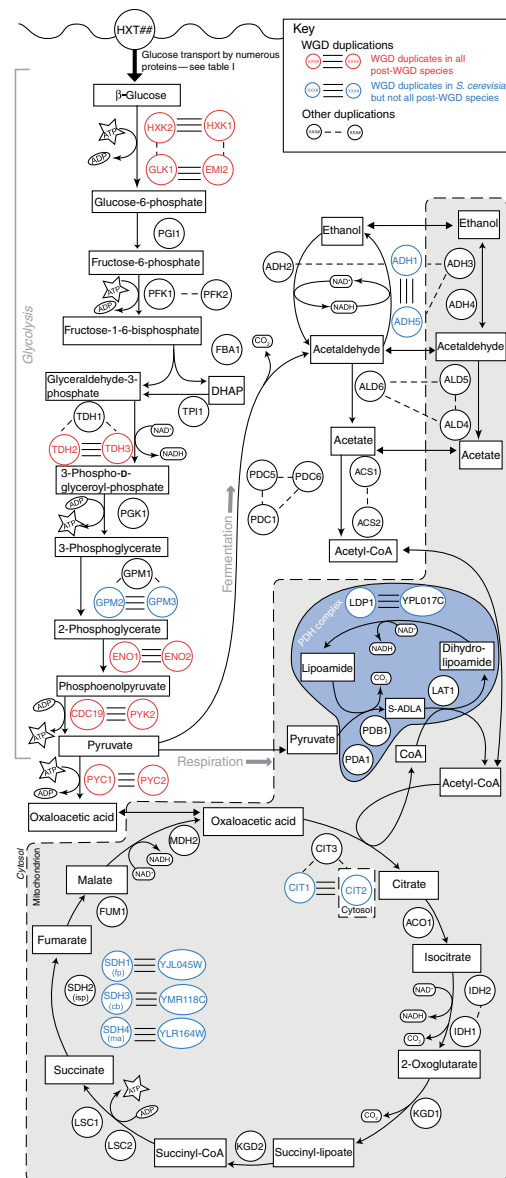
**Neofunctionalization**



# Subfunctionalization following WGD



# Increase in metabolic flux following WGD



Conant and Wolfe. Mol Syst Biol. 2007;3:129.

# Mechanisms of genome evolution

