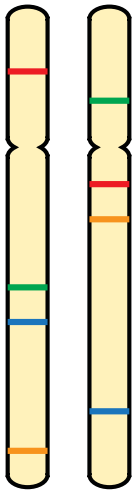
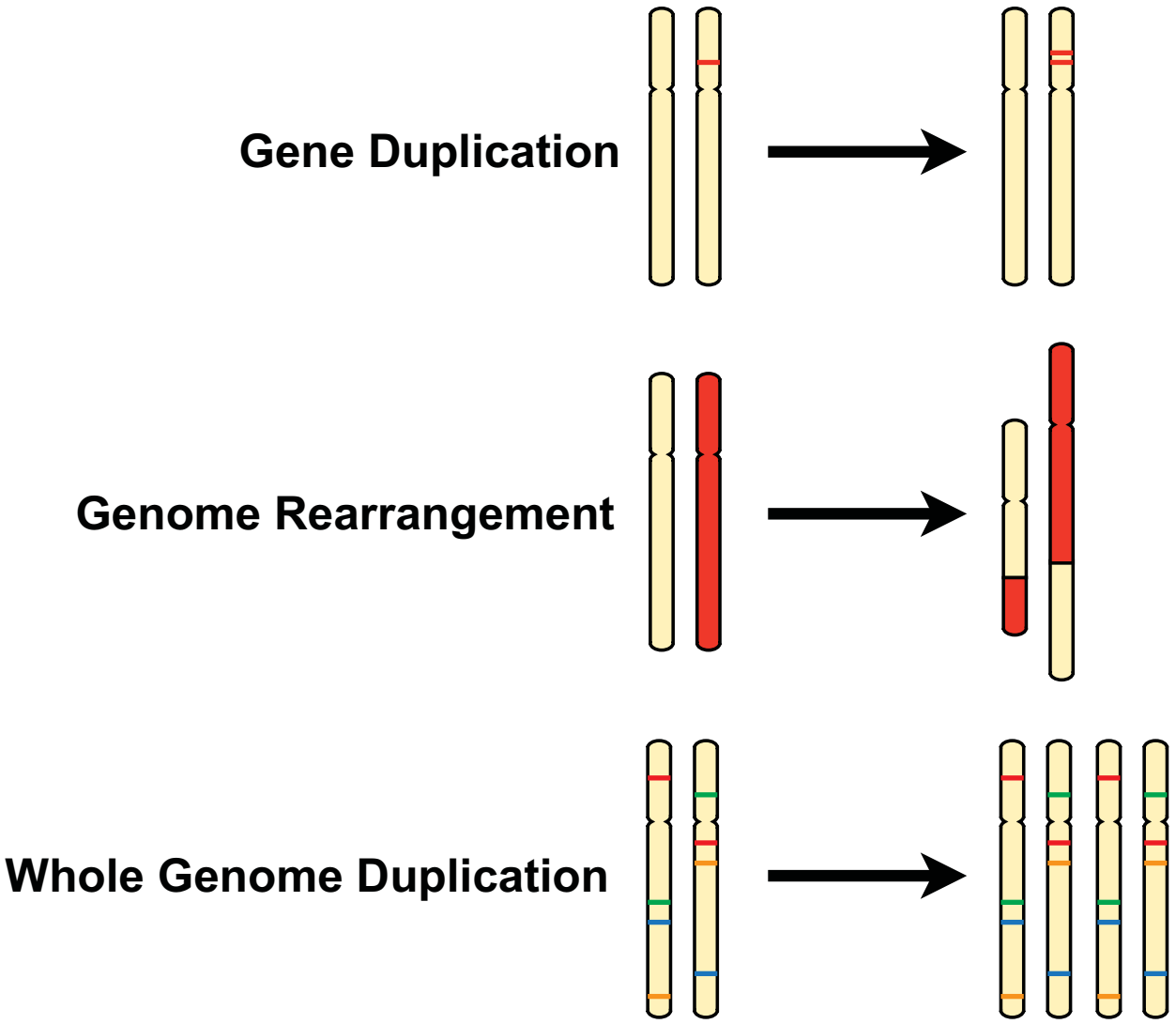


Genome Evolution

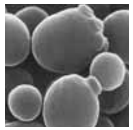
Greg Lang, Department of Biological Sciences

BioS 010: Bioscience in the 21st Century

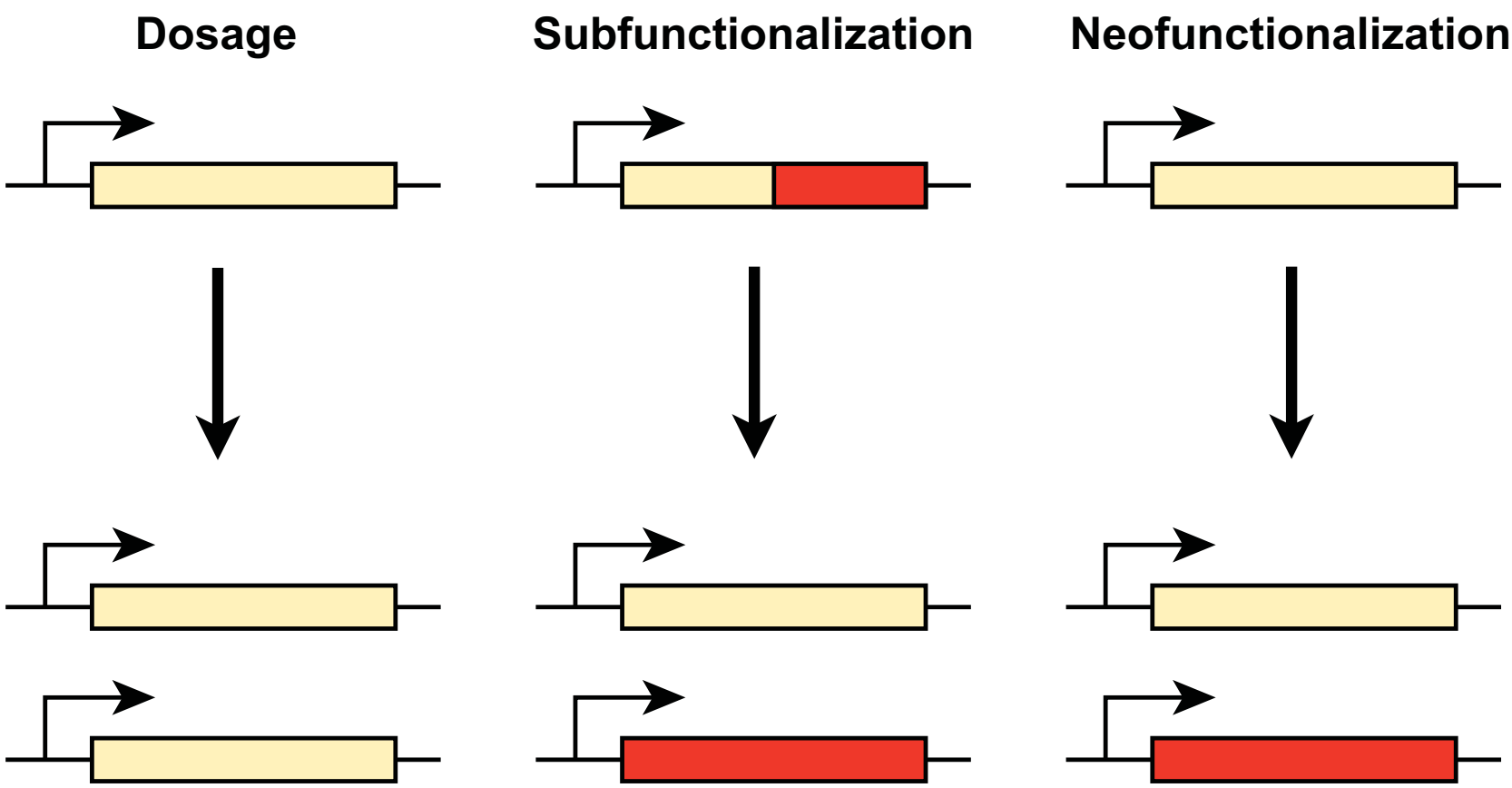
Mechanisms of genome evolution



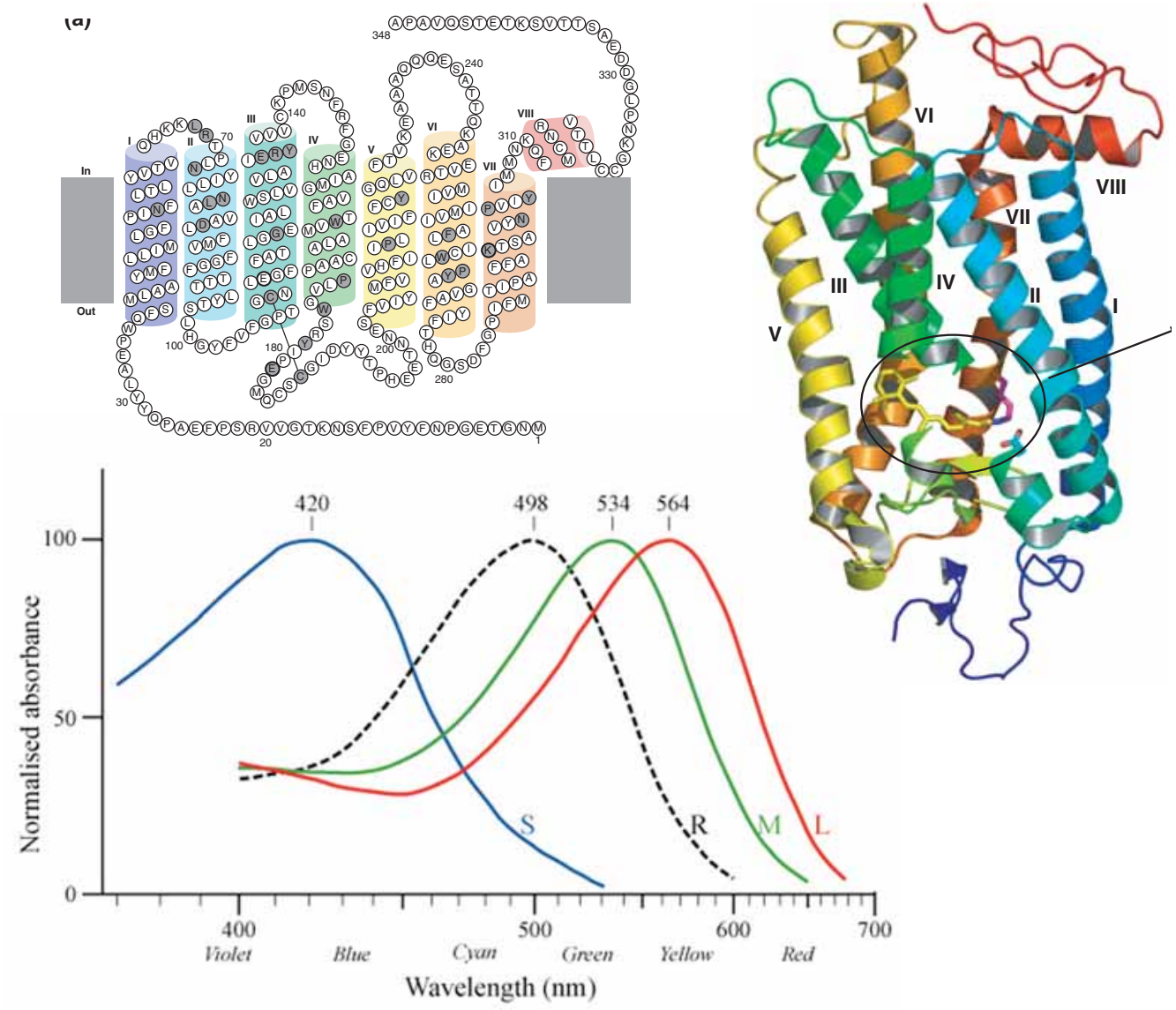
Gene number varies between species

Species		Gene #
Saccharomyces cerevisiae		6,294
Neurospora crassa		10,082
Drosophila melanogaster		13,600
Caenorhabditis elegans		19,000
Homo sapiens		20,251
Takifugu rubripes		22-29,000
Arabadopsis thaliana		27,400
Oryza sativa		32-50,000
Populus trichocarpa		45,555

Fates of duplicated genes

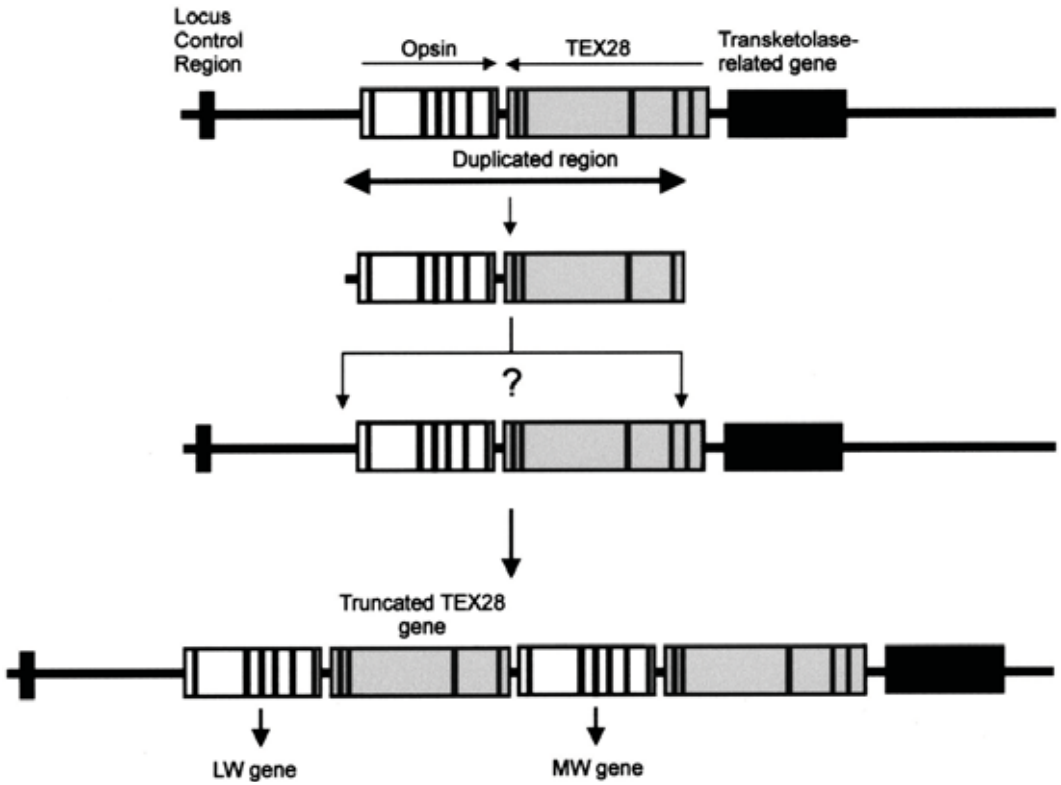


Human opsin genes and trichromatic vision



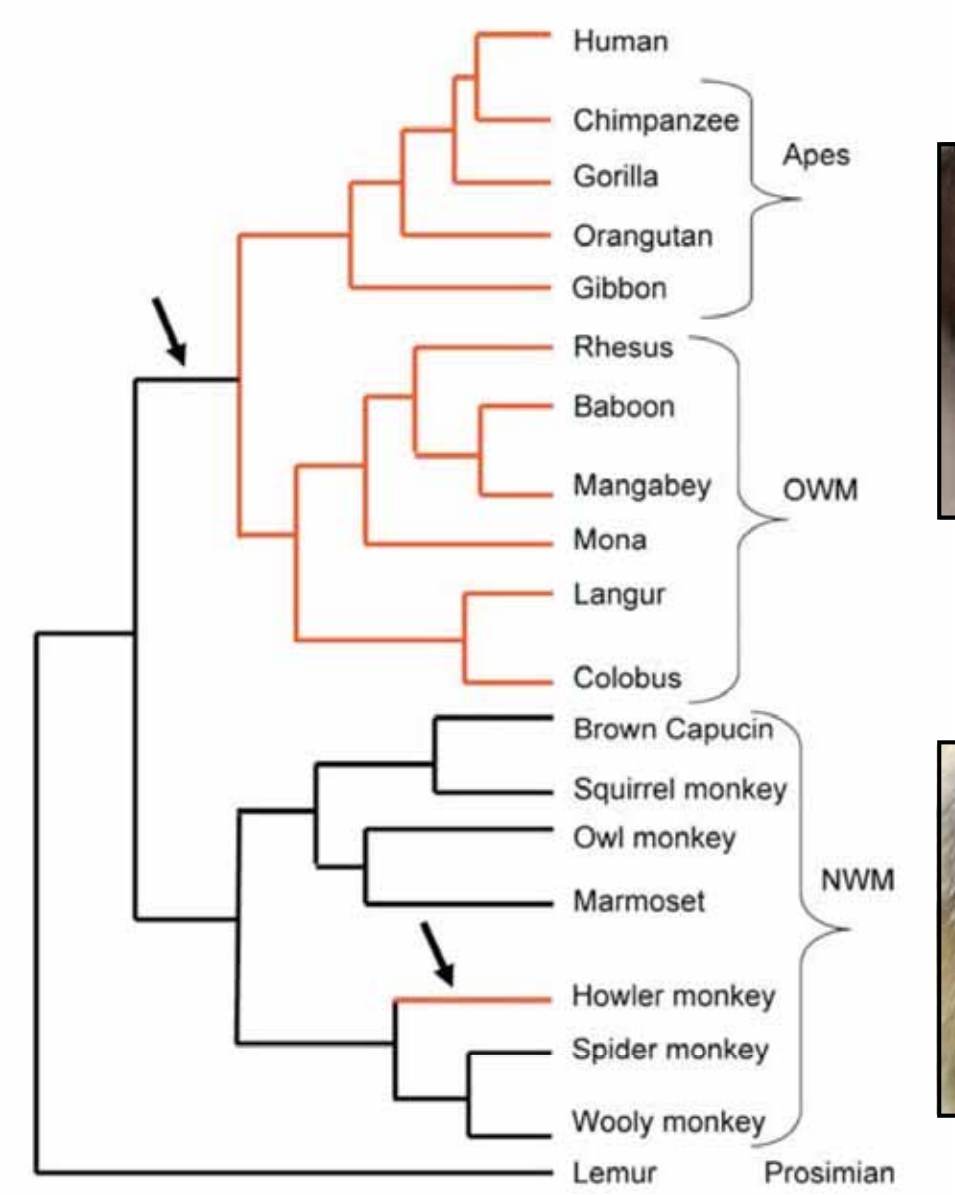
Terakita. Genome Biol. 2005;6(3):213.

Duplication of opsin genes in old-world primates



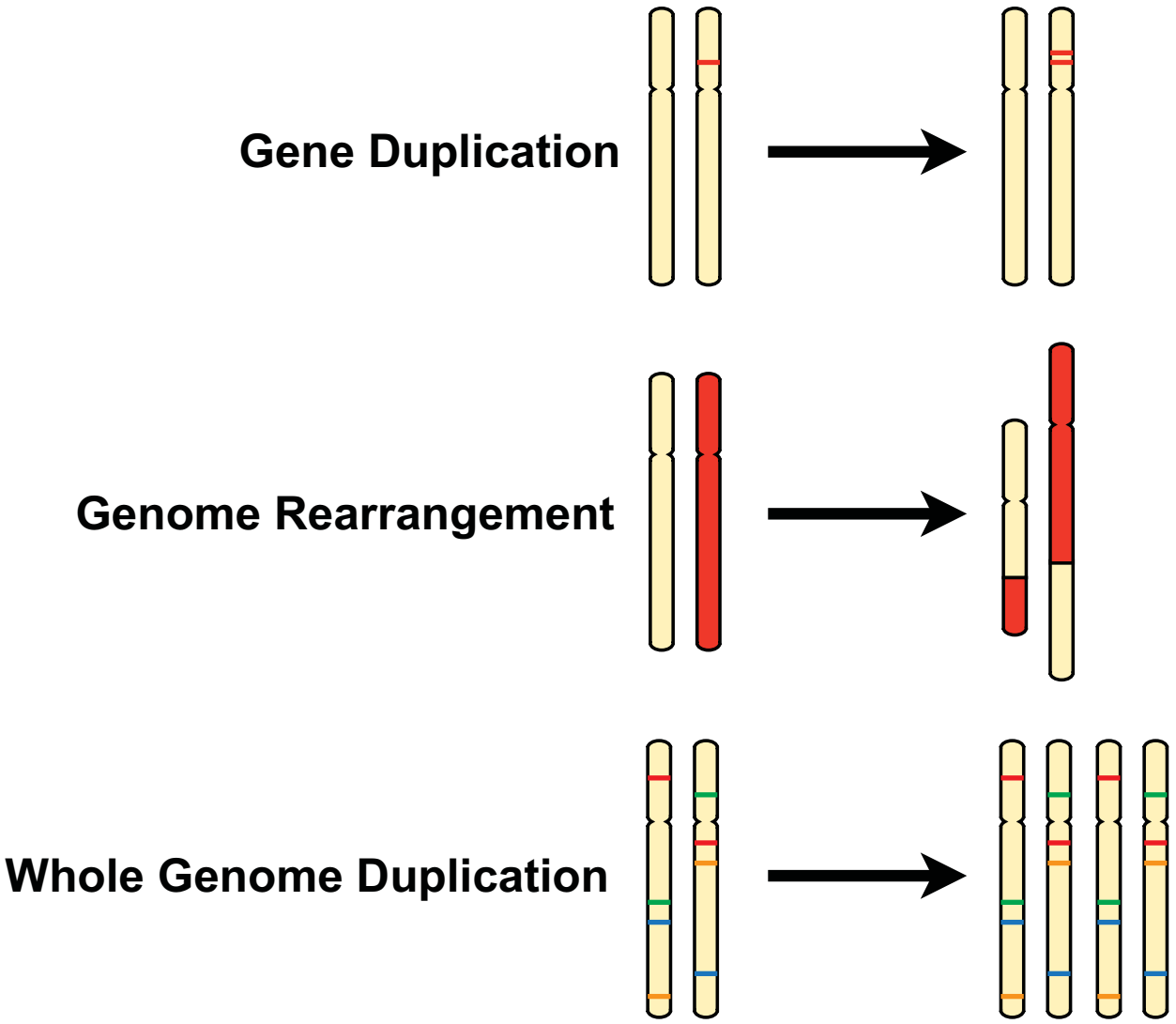
Dulai et al. Genome Res. 1999 Jul;9(7):629-38.

Trichromatic vision in howler monkeys



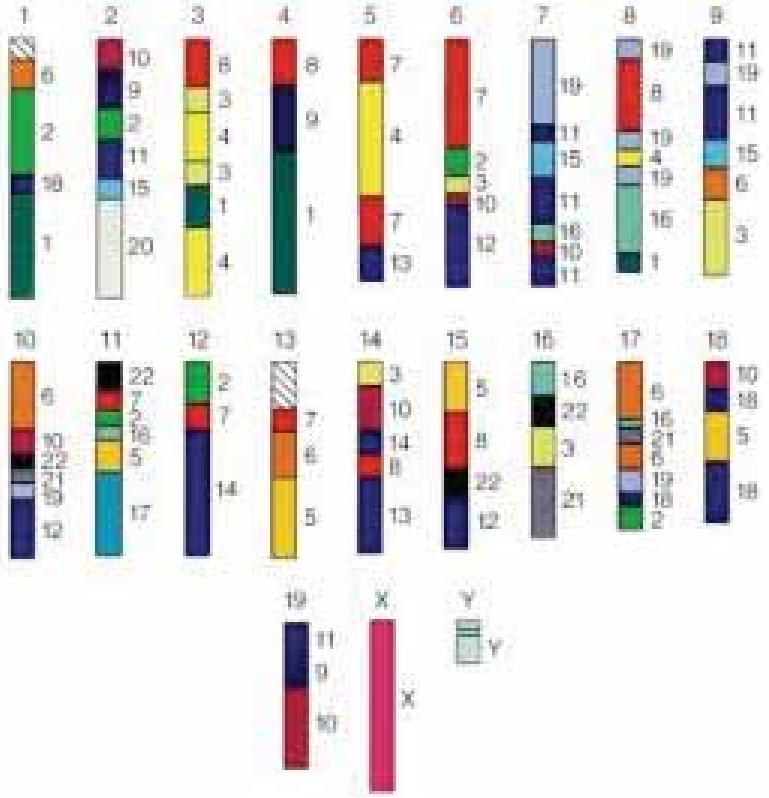
Gilad et al. PLoS Biol. 2004 Jan;2(1):E5.

Mechanisms of genome evolution

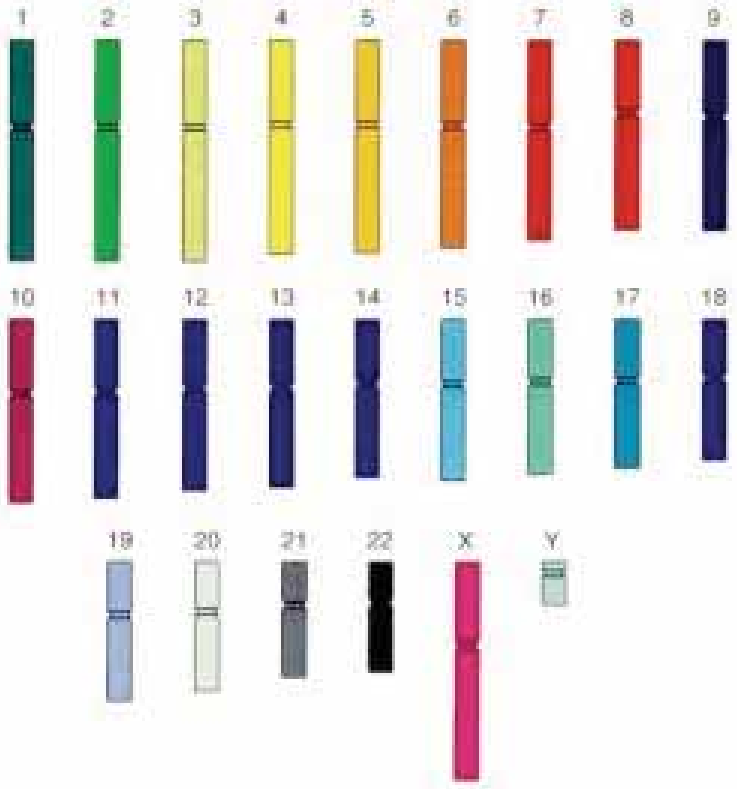


Genomes rearrange during evolution

Mouse Genome



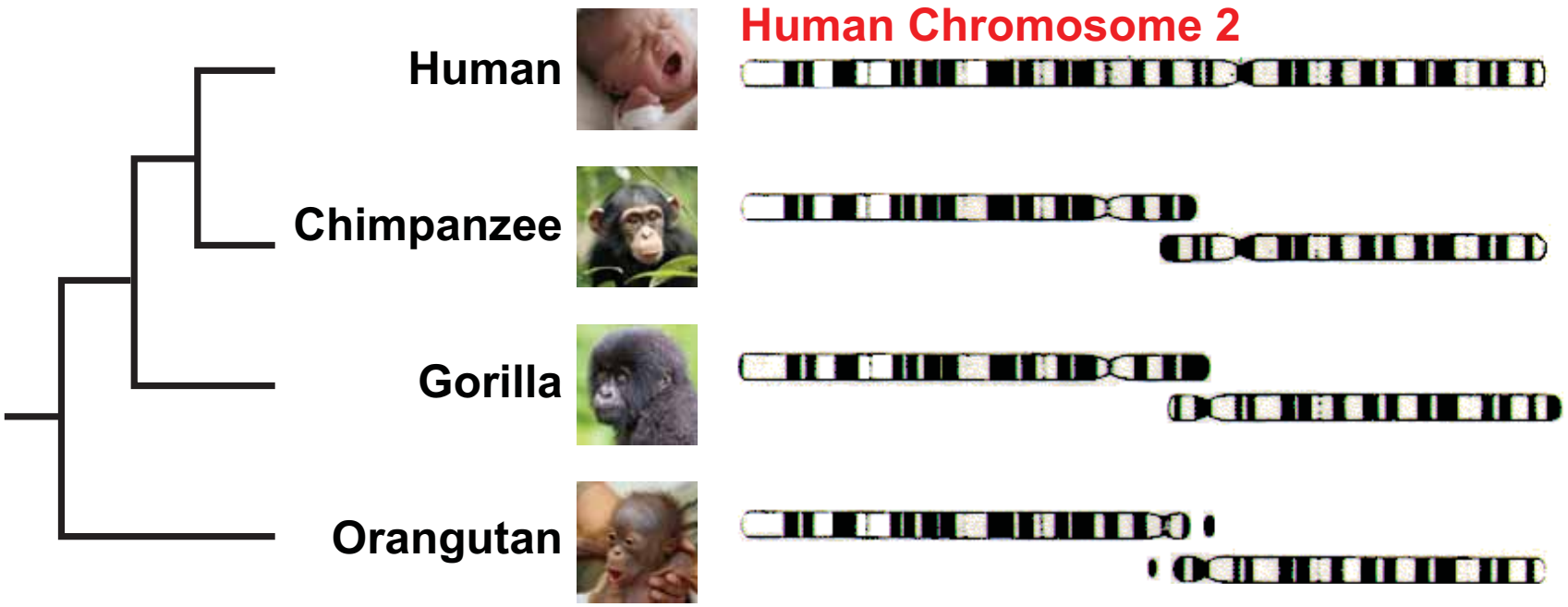
Human Genome



U.S. Department of Energy Human Genome Program: http://www.ornl.gov/hgmis

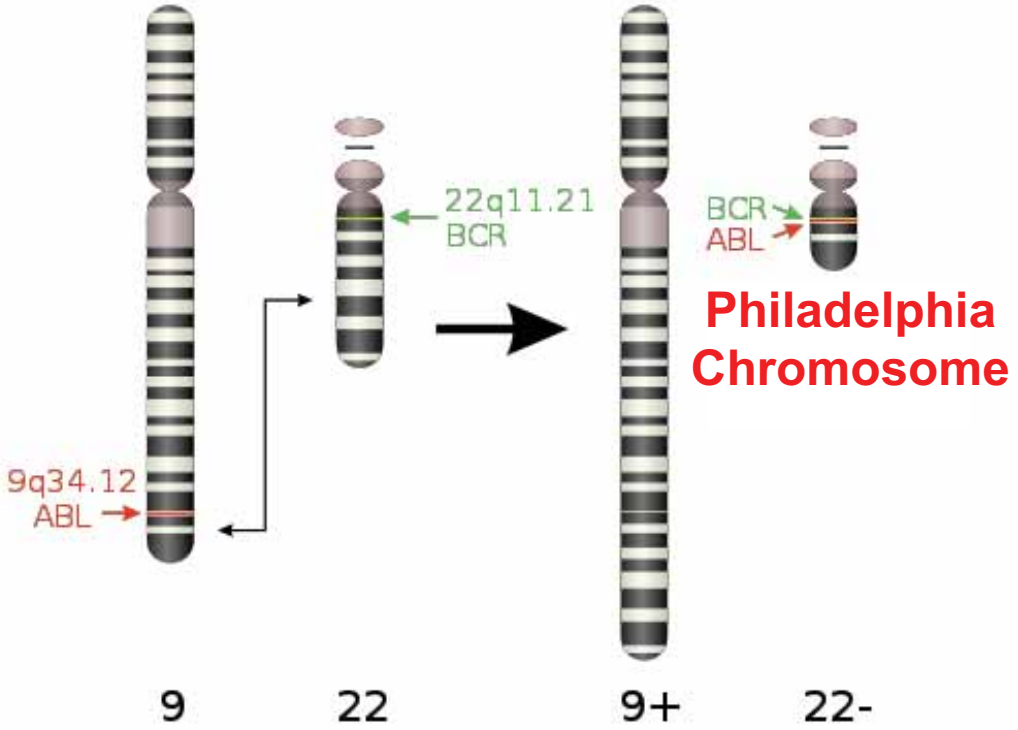
The “missing” human chromosome

Human Chromosome 2 arose through fusion

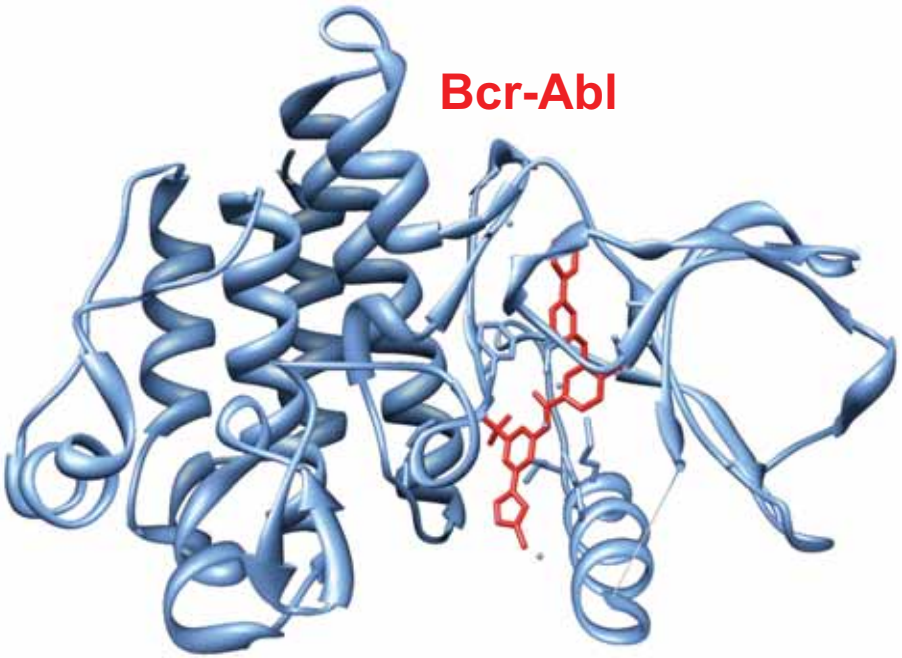


Yunis and Prakash. Science. 1982 Mar 19;215(4539):1525-30.

Genome rearrangement in cancer

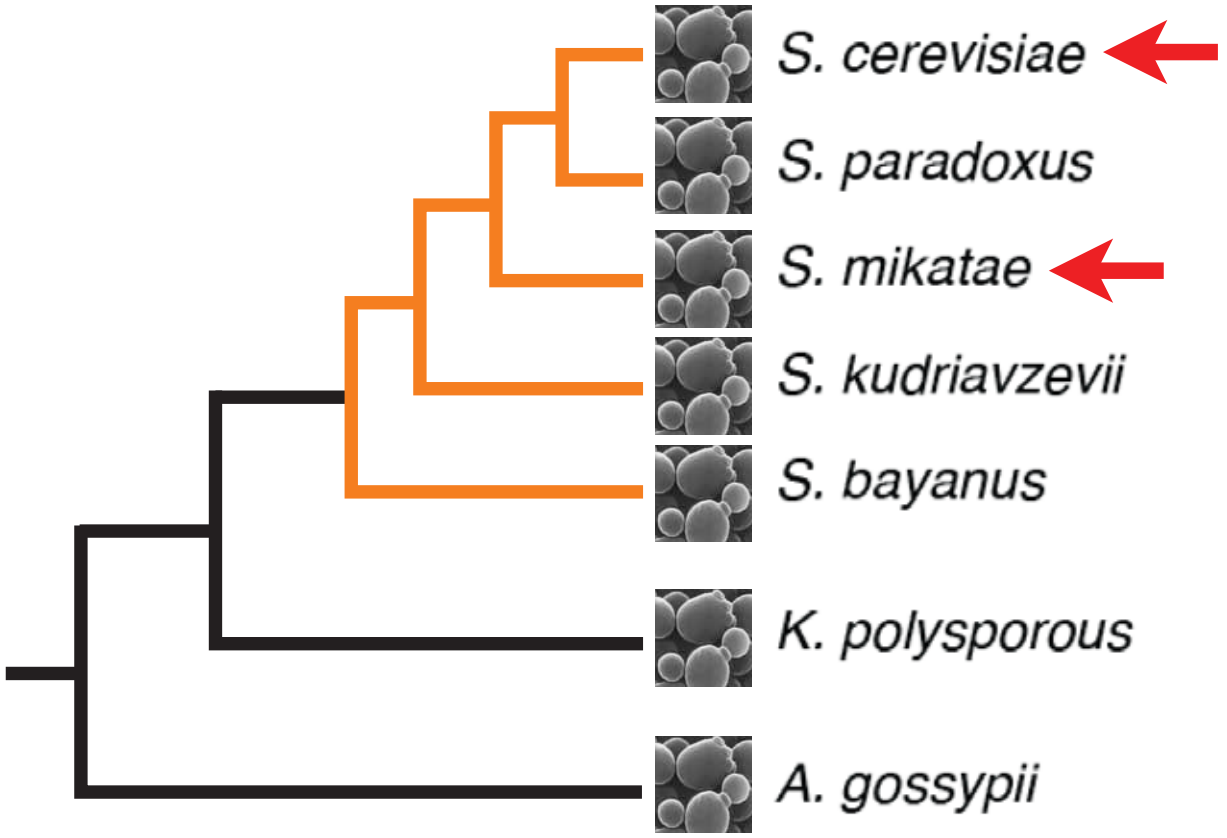


Philadelphia Chromosome

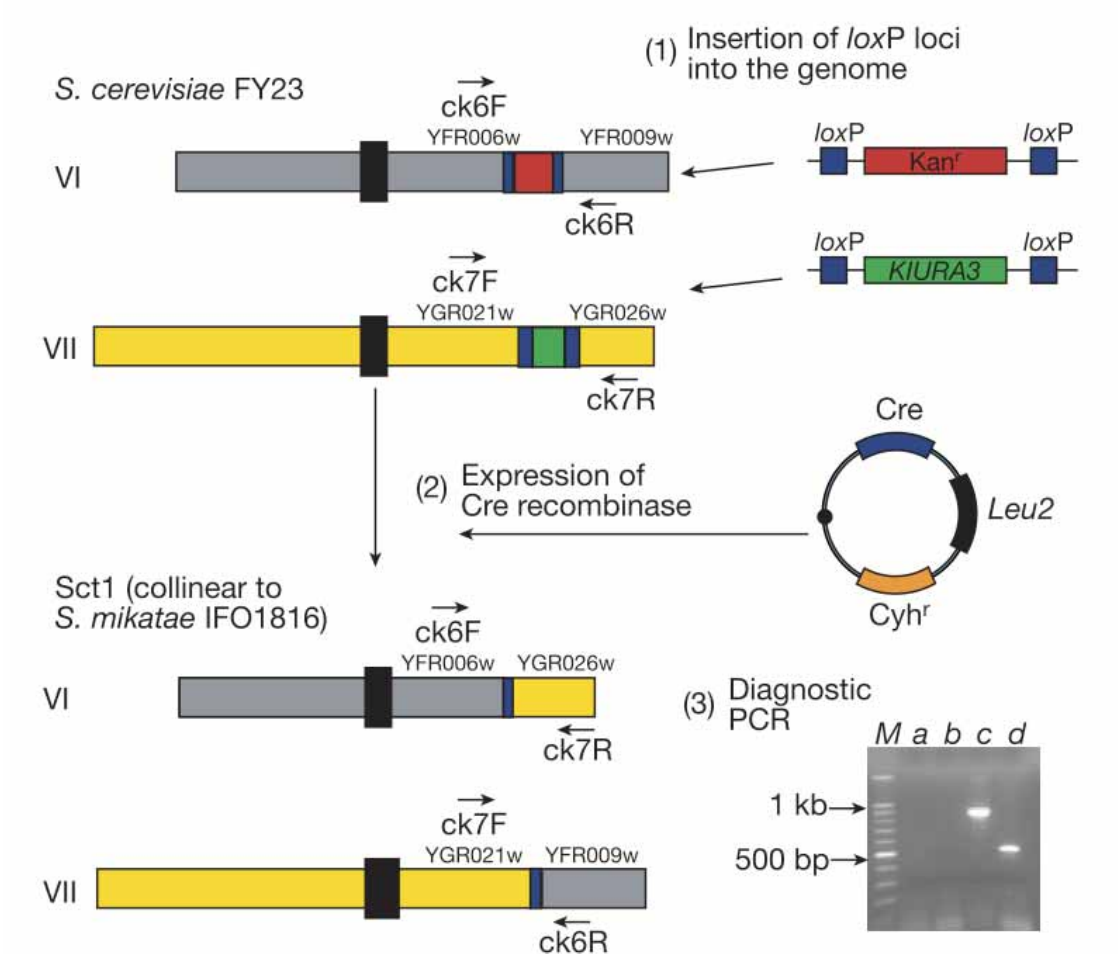


Wikimedia Commons

Genome rearrangements as a genetic barrier



Engineering evolution to study speciation in yeast



Delneri et al. Nature. 2003 Mar 6;422(6927):68-72.

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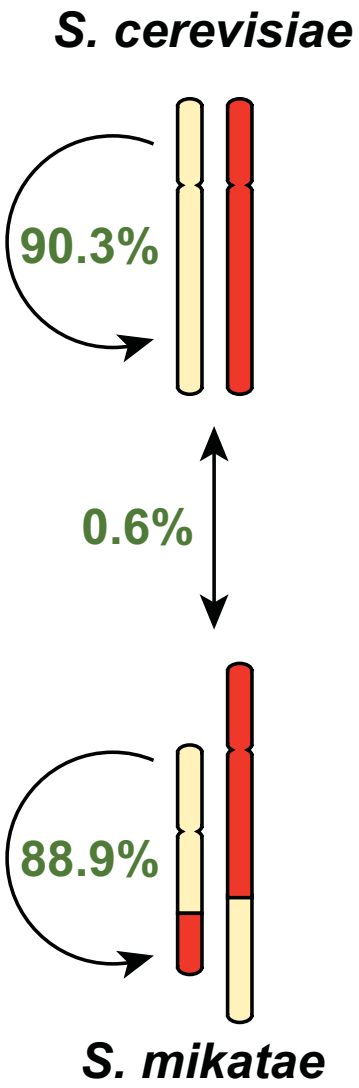

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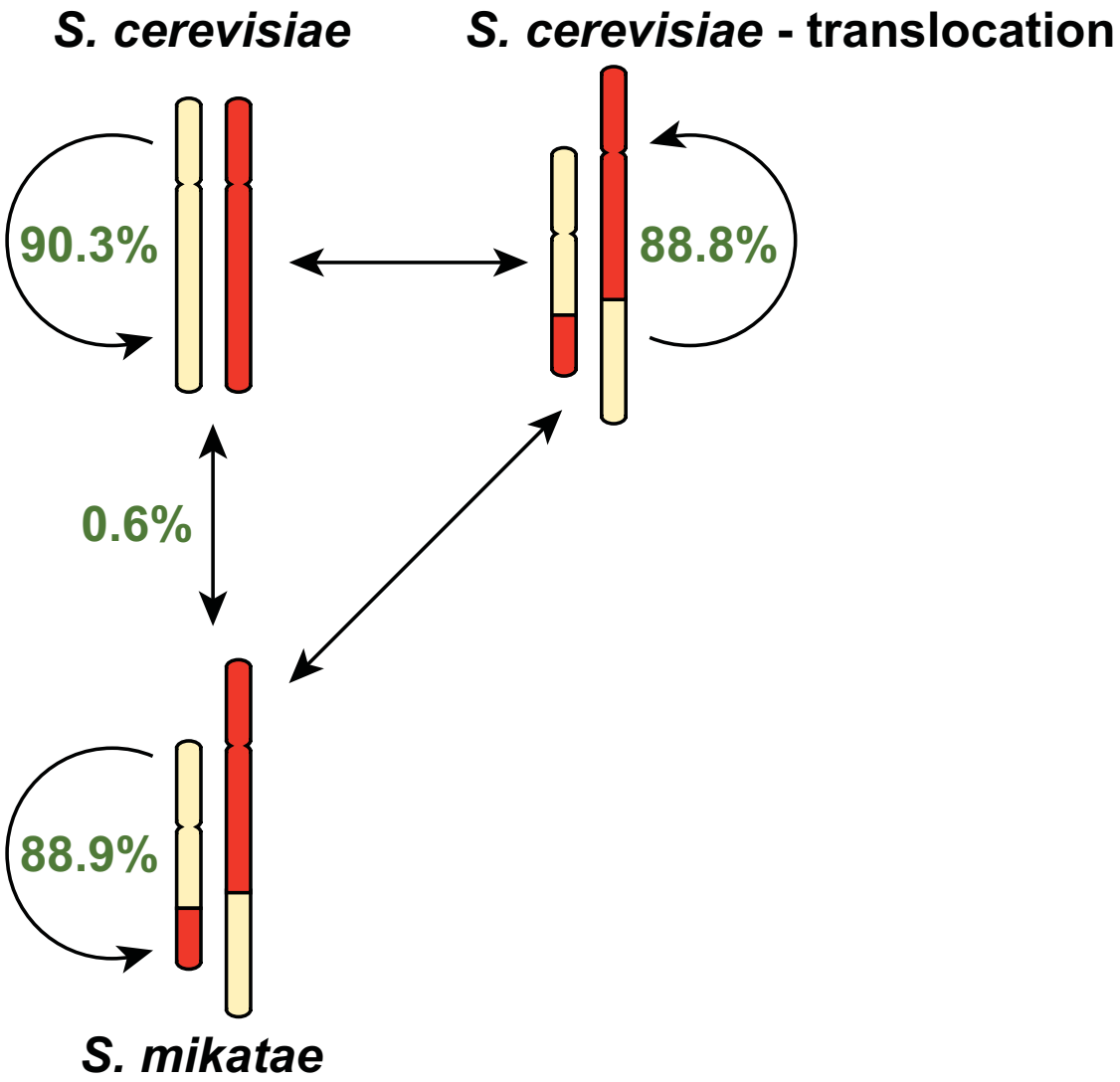

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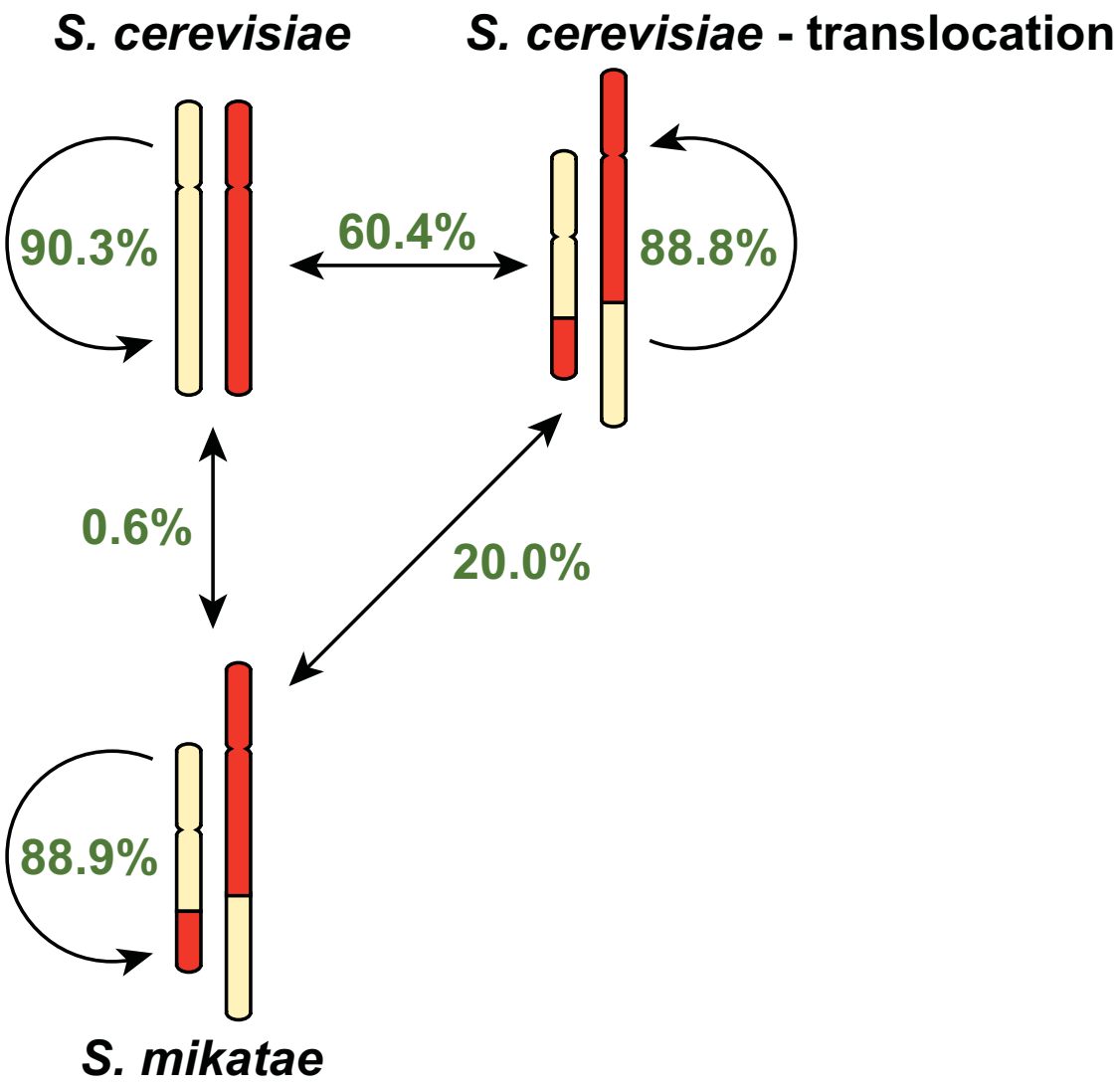

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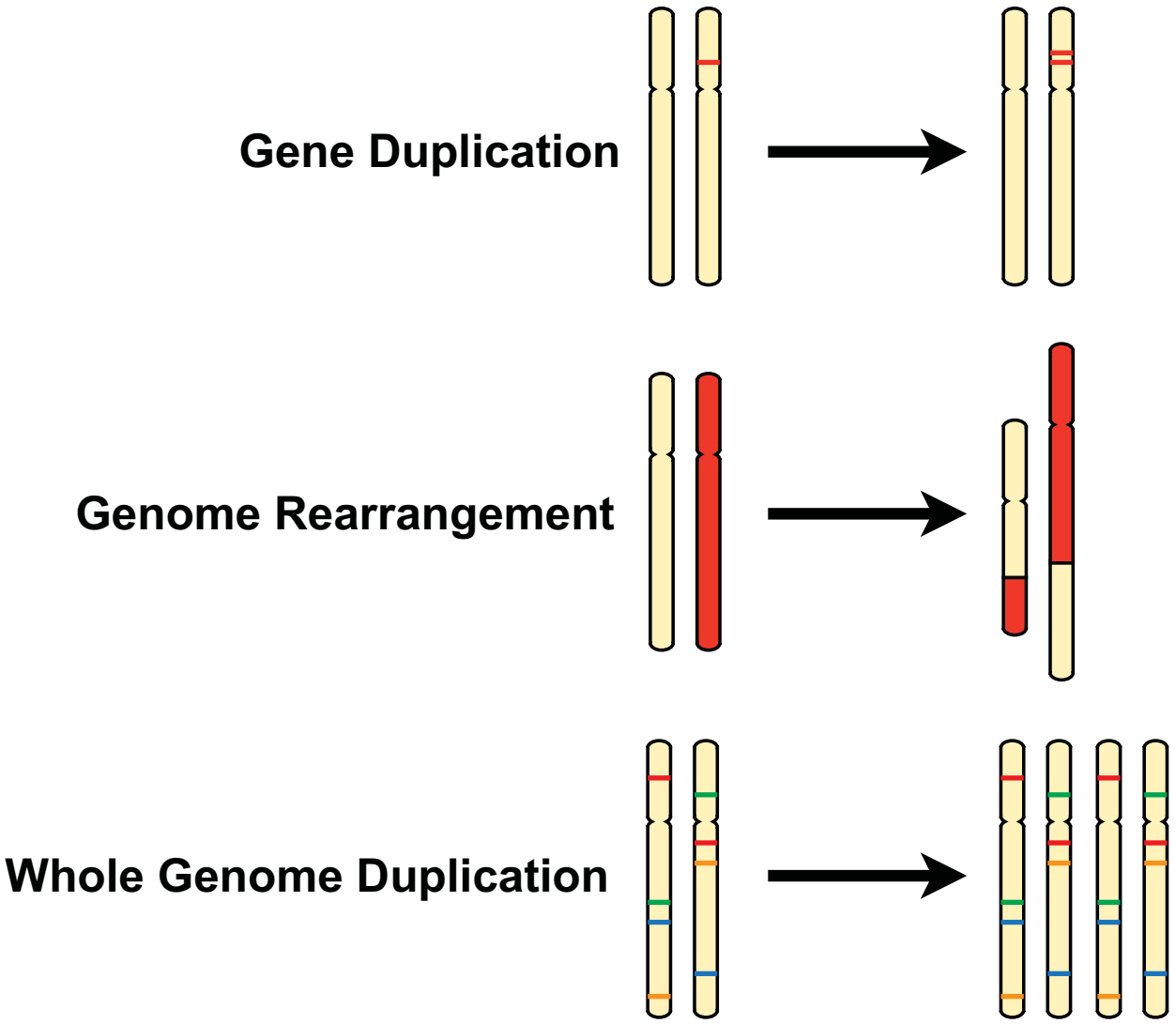
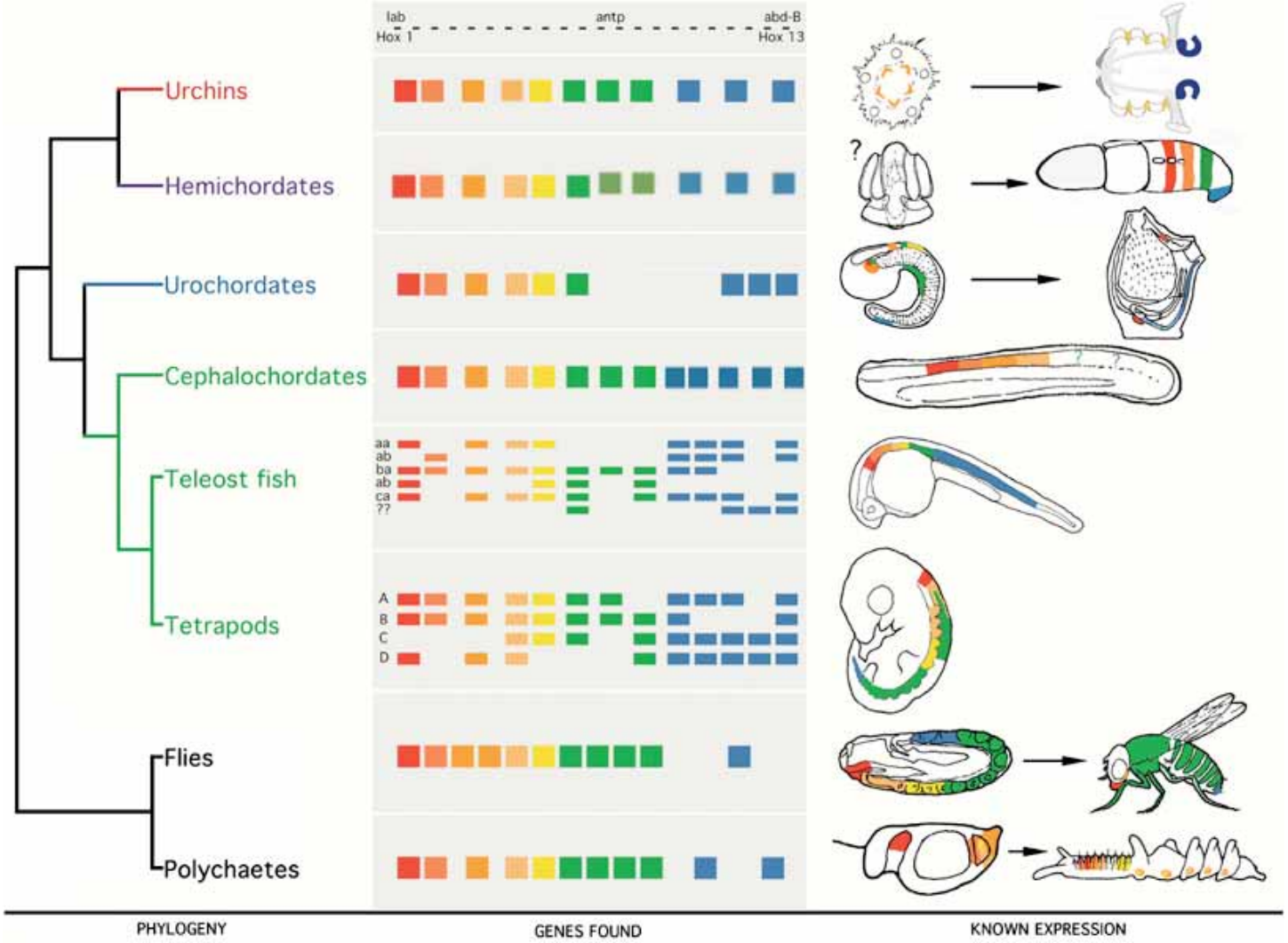
Mechanisms of genome evolution



Evidence of two WGDs in vertebrate Hox clusters



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

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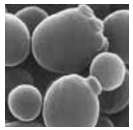
Saccharomyces cerevisiae		6,294
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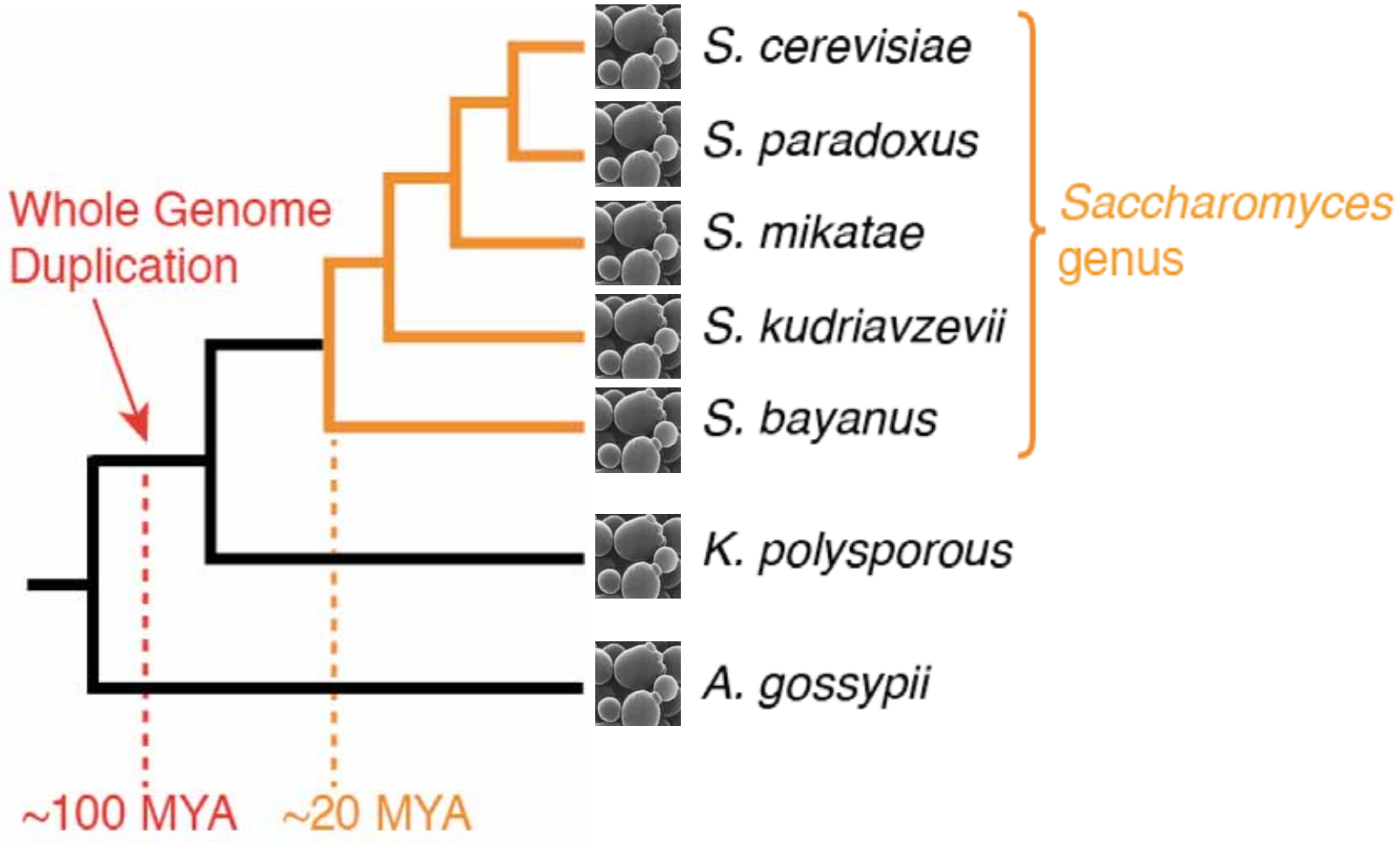
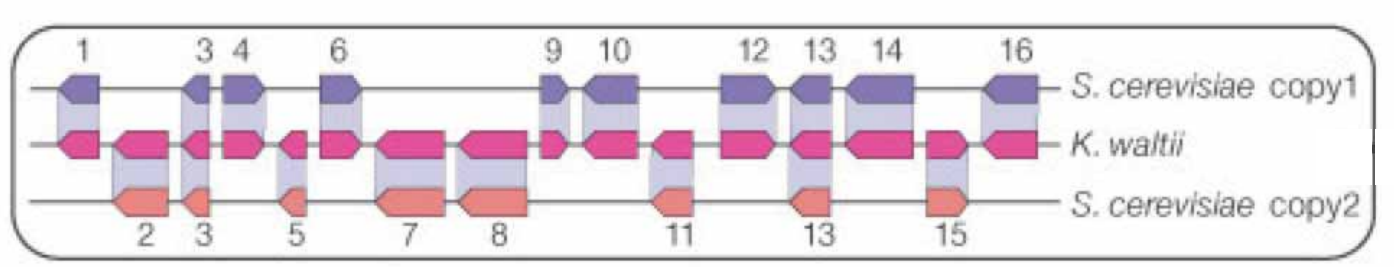


Evidence for a whole-genome duplication in yeast



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

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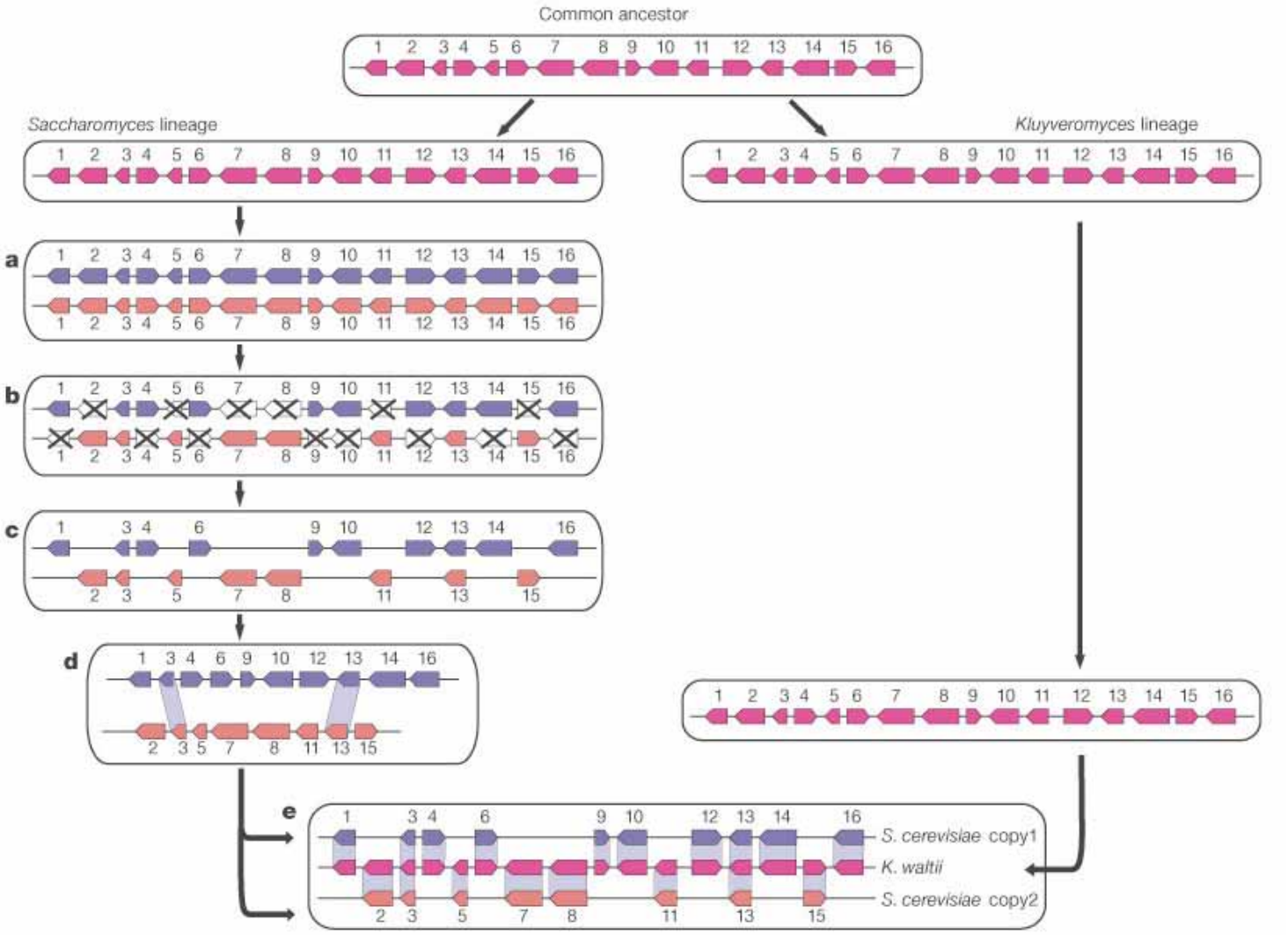
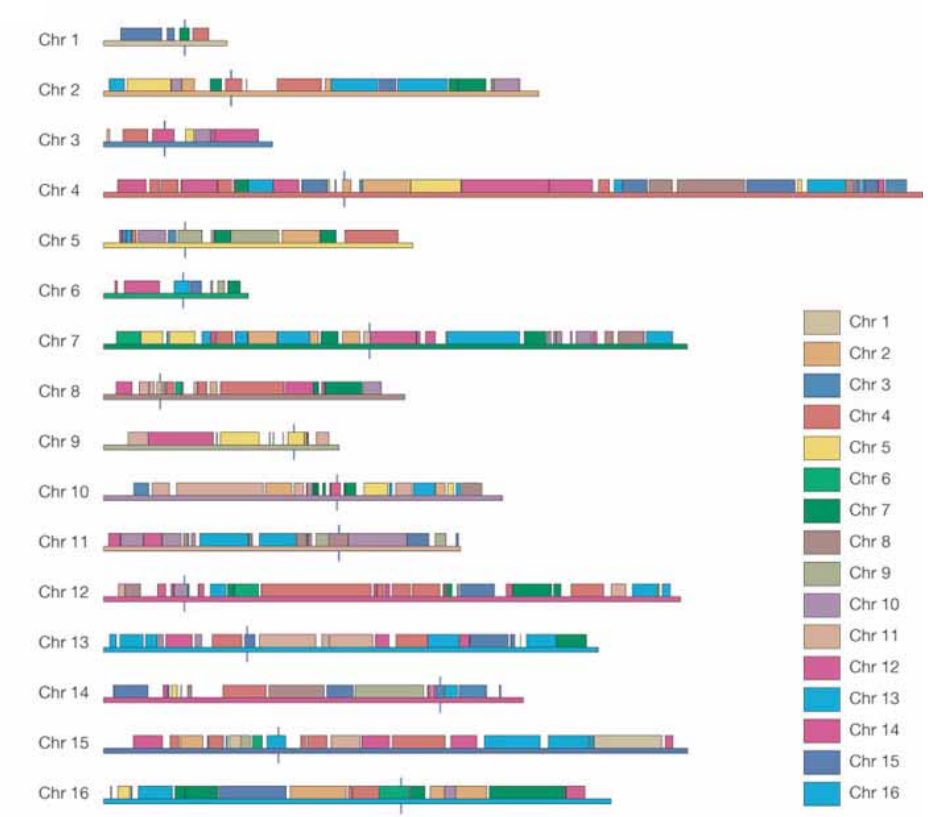
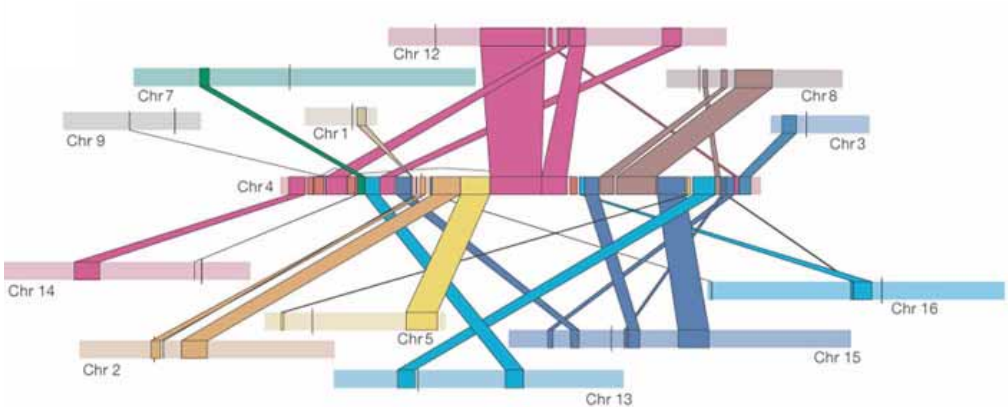


Kellis et al. Nature. 2004 Apr 8;428(6983):617-24.

Analysis of the whole-genome duplication in yeast





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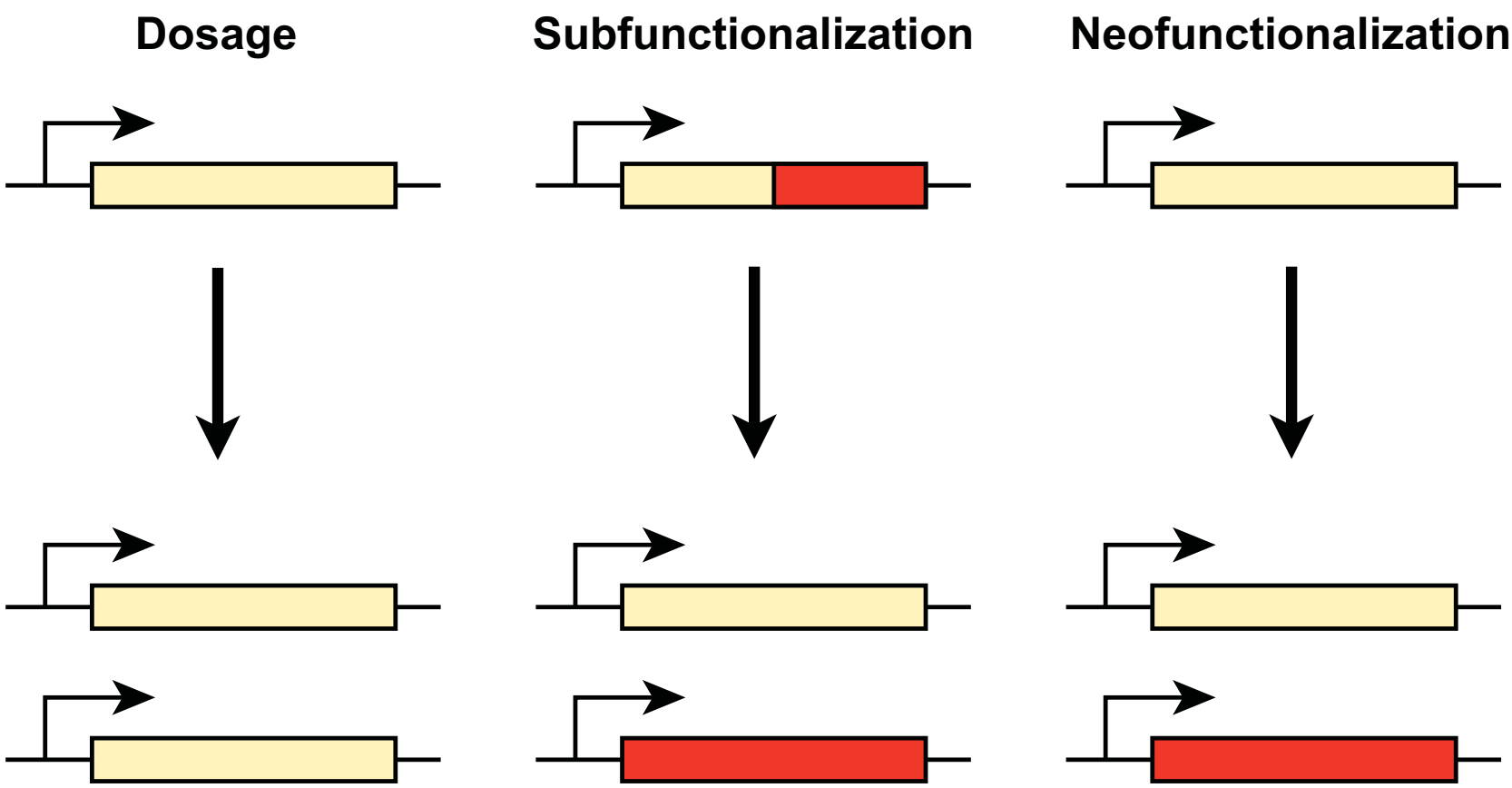
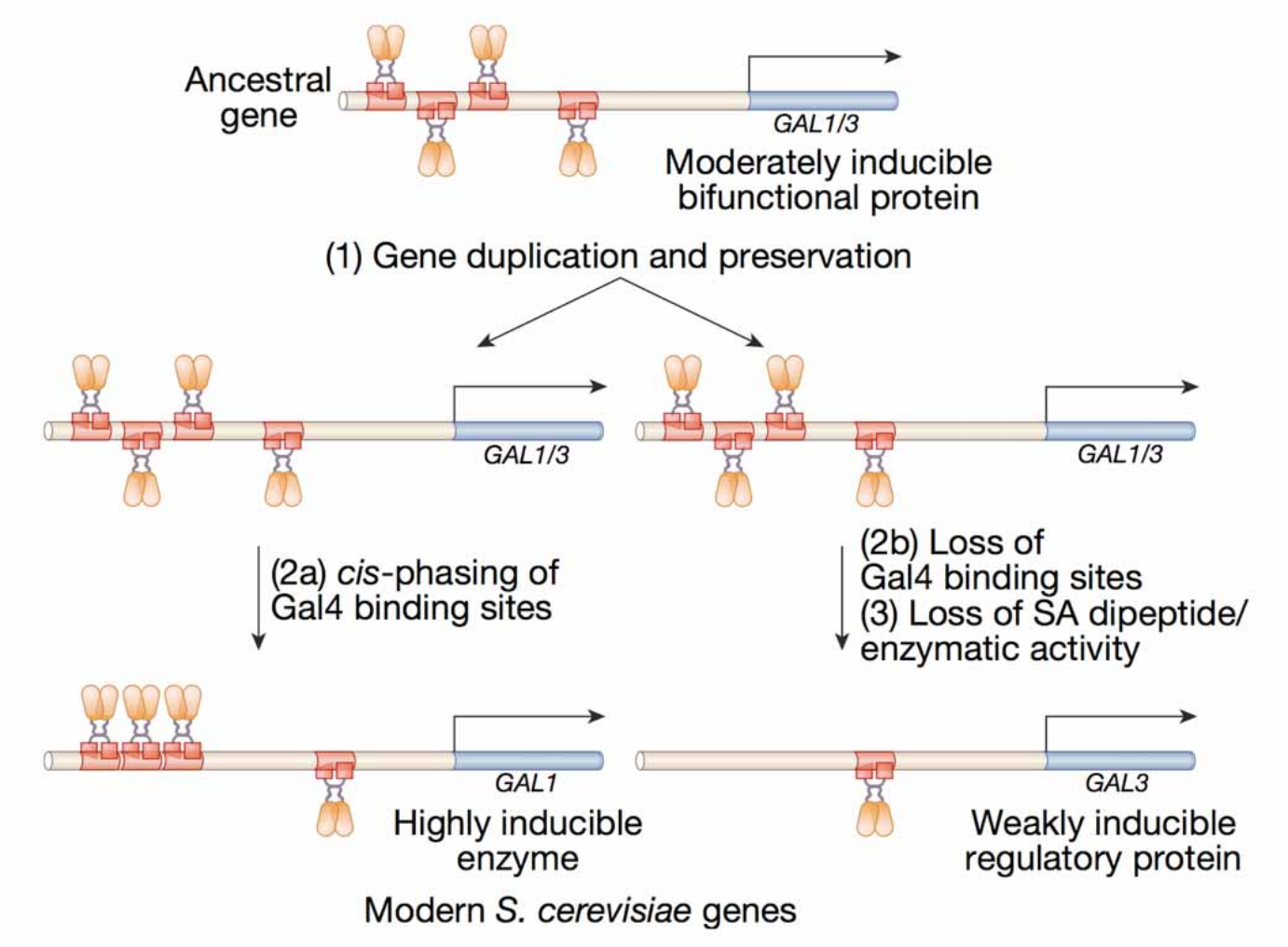
Fates of duplicated genes

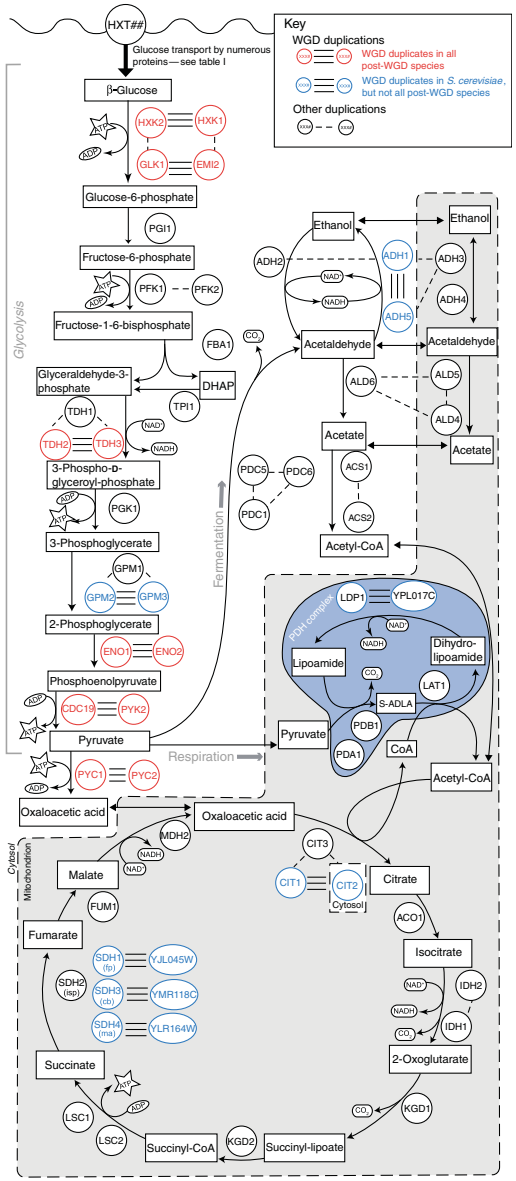


Subfunctionalization following WGD



Hittinger and Carroll. Nature. 2007 Oct 11;449(7163):677-81.

Increase in metabolic flux following WGD



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

Mechanisms of genome evolution