



University of  
Zurich<sup>UZH</sup>

## About Me: Rie Shimizu-Inatsugi

Group leader

Evolutionary Biology and Environmental Studies, UZH



University of  
Zurich<sup>UZH</sup>

PostDoc

Marie-Heim Vögtlin Program (SNF)

Group leader



Bachelor

Master

PhD

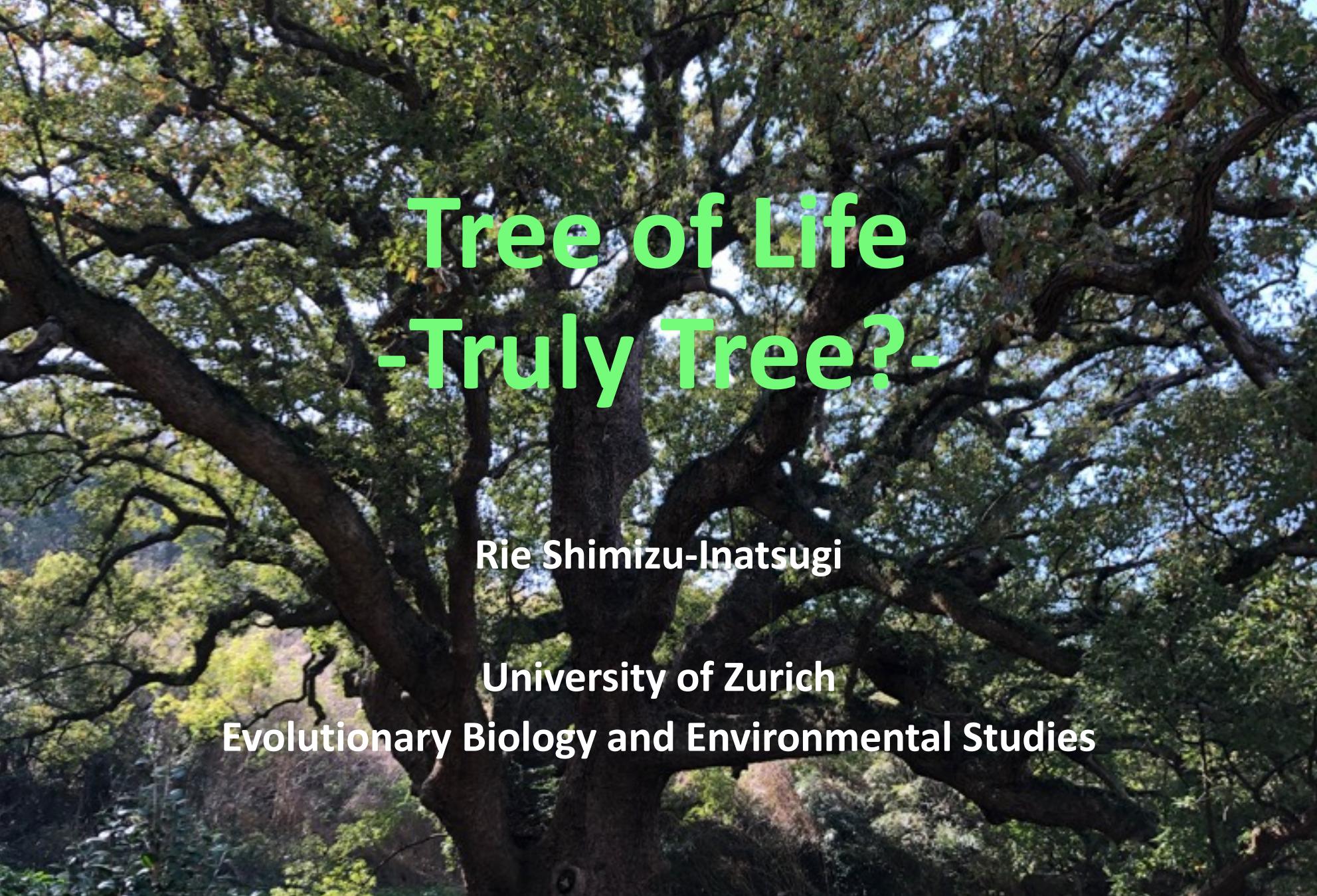
PostDoc (Higashiyama Lab)

**ETH** zürich

teaching some student courses

Main research interest: Evolutionary biology, Plant ecogenomics

Symposium University of Tokyo – ETH Zurich – University of Zurich



# **Tree of Life -Truly Tree?-**

Rie Shimizu-Inatsugi

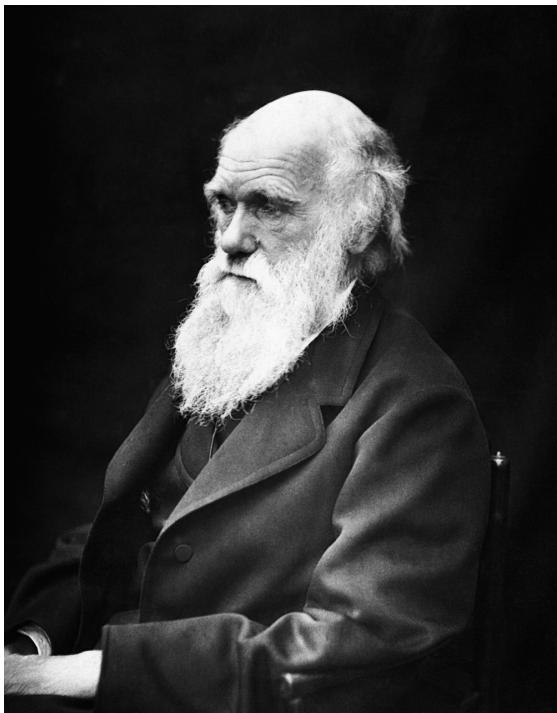
**University of Zurich  
Evolutionary Biology and Environmental Studies**



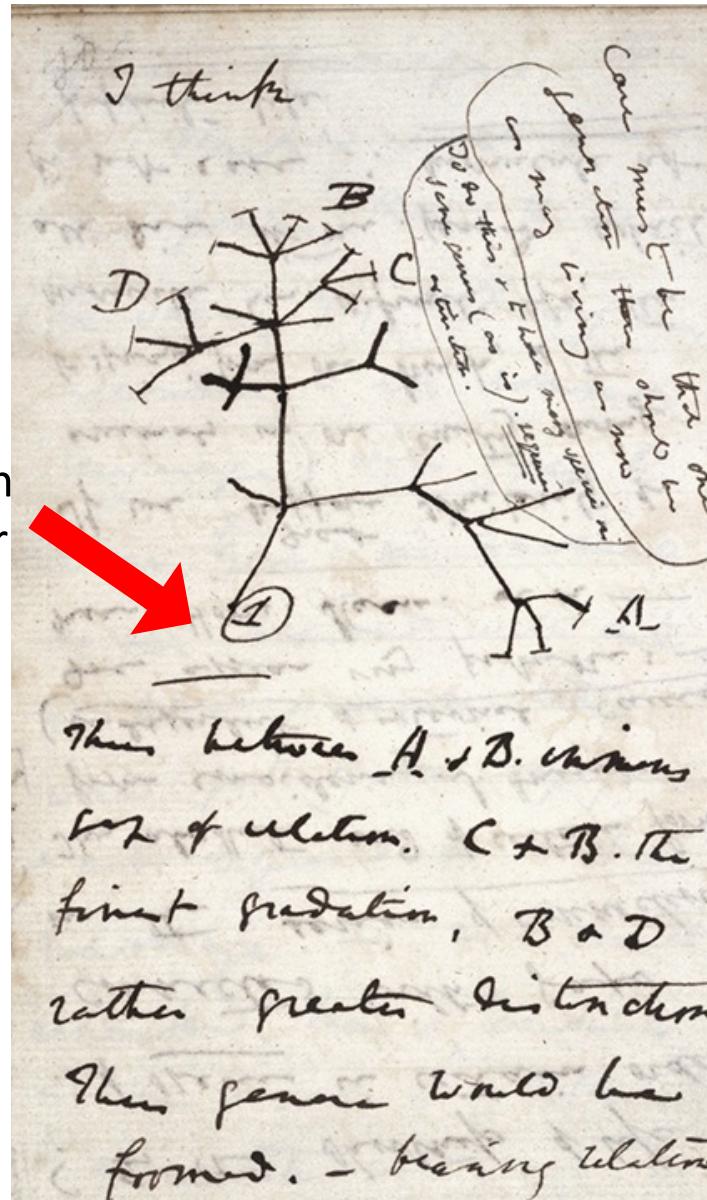
# Early Idea of 'Tree of Life'

1837

Charles Darwin (1809 - 1882)  
Father of Evolutionary Biology



Common  
Ancestor





# Biodiversity, as a Result of Tree

## ANGIOSPERM PHYLOGENY

### Flowering Plant Systematics



Common Ancestor of Angiosperm

<https://doi.org/10.7490/f1000research.1110237.1>



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and Systematics

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ANGIOSPERM  
PHYLOGENY  
POSTER





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# Truly Tree?



# Feature of Tree

Canopy  
**Contemporary  
Species**

Expand as fan  
**Diversification**

Branching  
**Speciation**

Root  
**Common ancestor**



No ‘crossing’ btw. branches is assumed

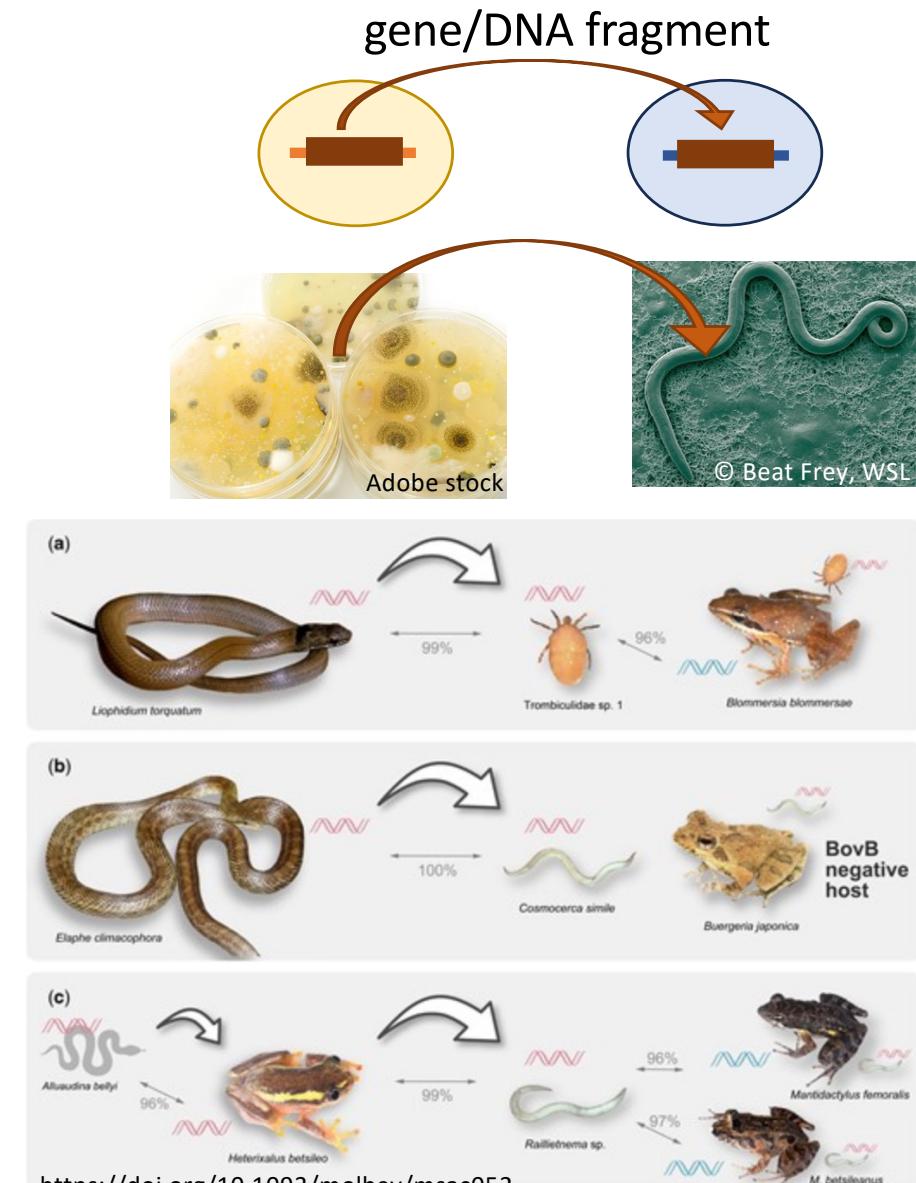
# Many Types of ‘Crossing’ in real evolution

## Ex. 1. Horizontal Gene Transfer

Bacterium to Bacterium  
Antidrug resistant genes

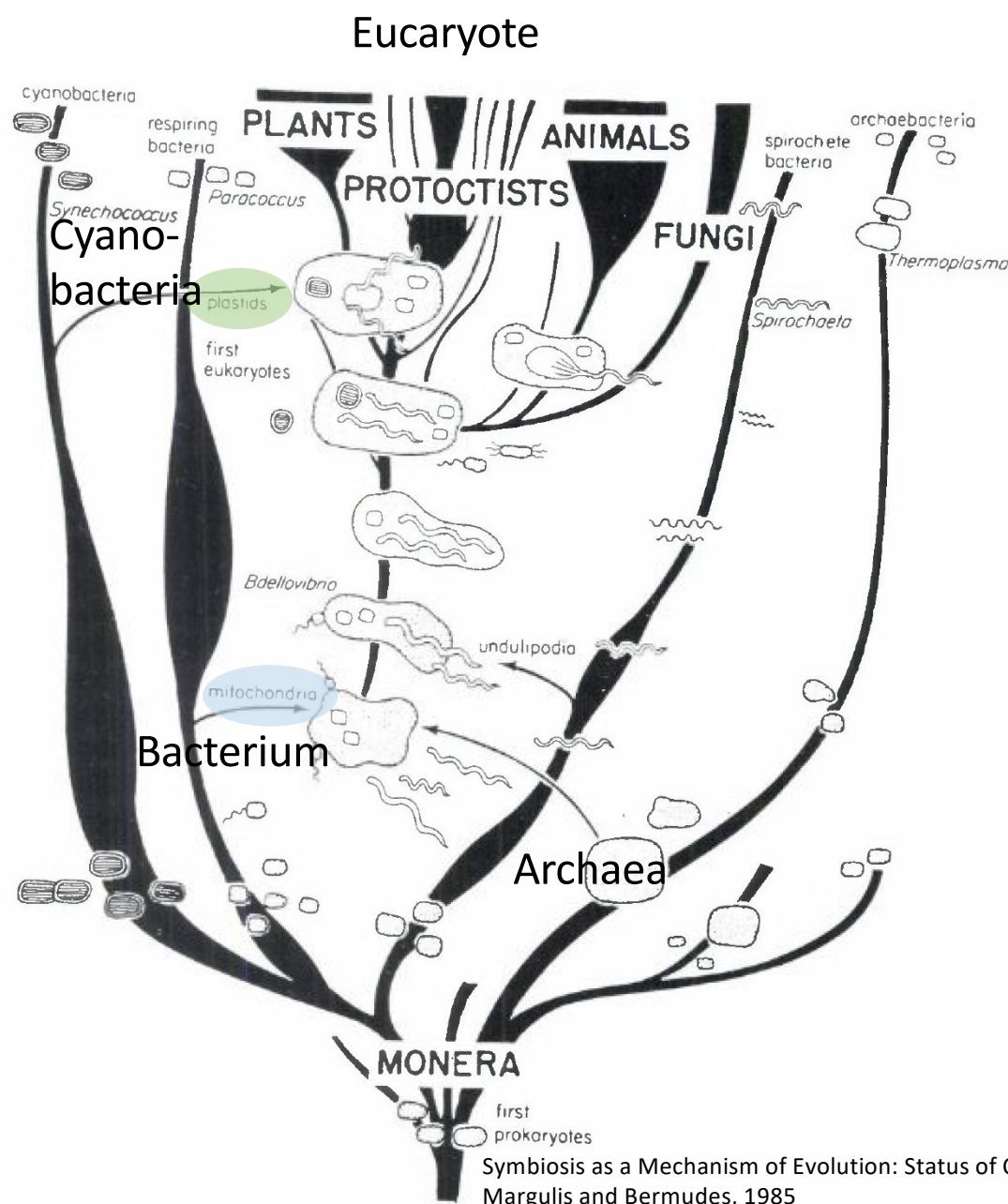
Fungi/Bacteria to Nematodes  
Cell wall digesting genes

Multiple species  
BovB Retrotransposon  
in Madagascar

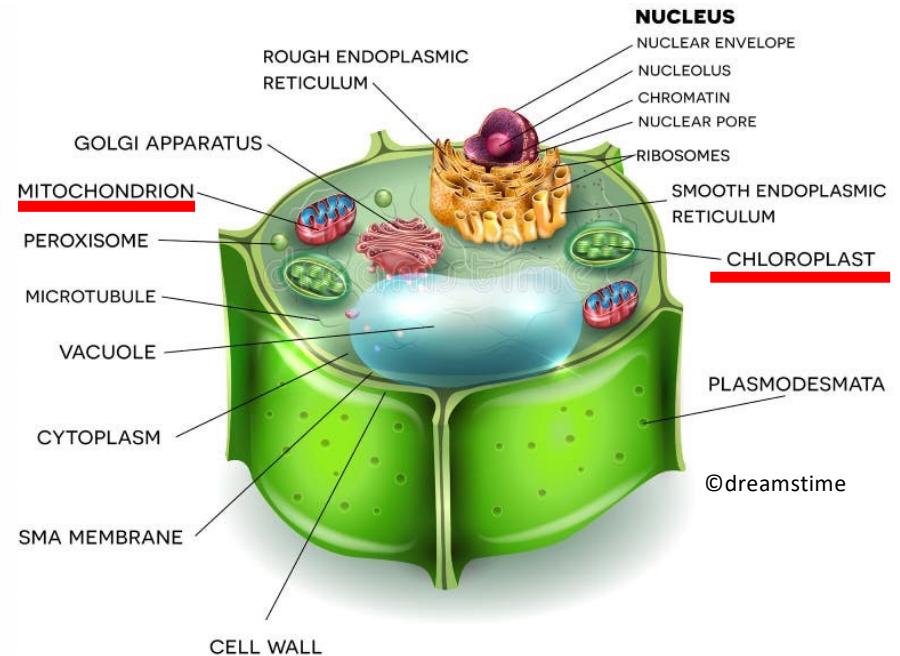




## Ex. 2. Endosymbiosis



Subcellular organelle in plant cell



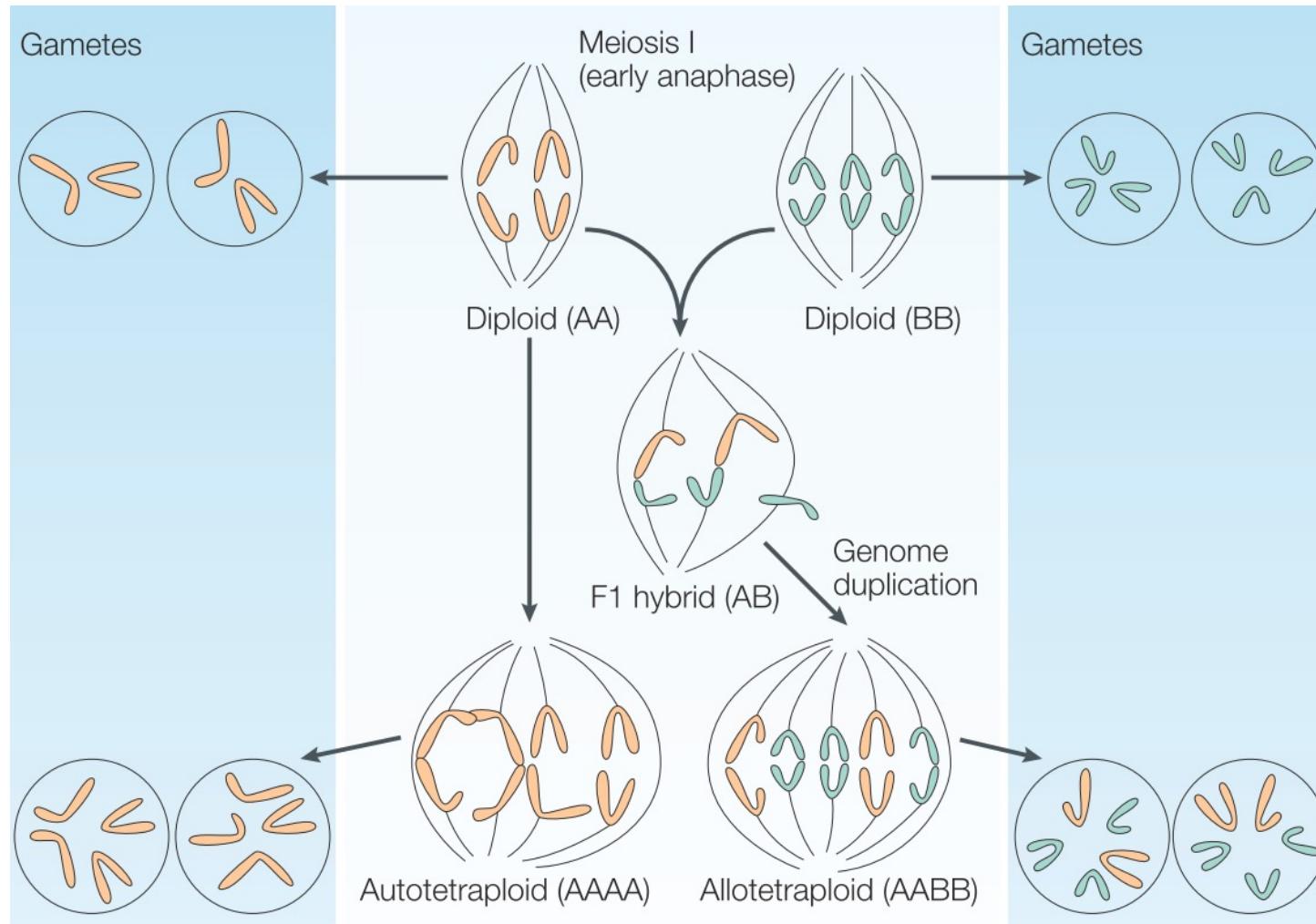
Mitochondria <- Aerobic Bacterium  
Respiration

Chloroplast <- Cyanobacterium  
Photosynthesis

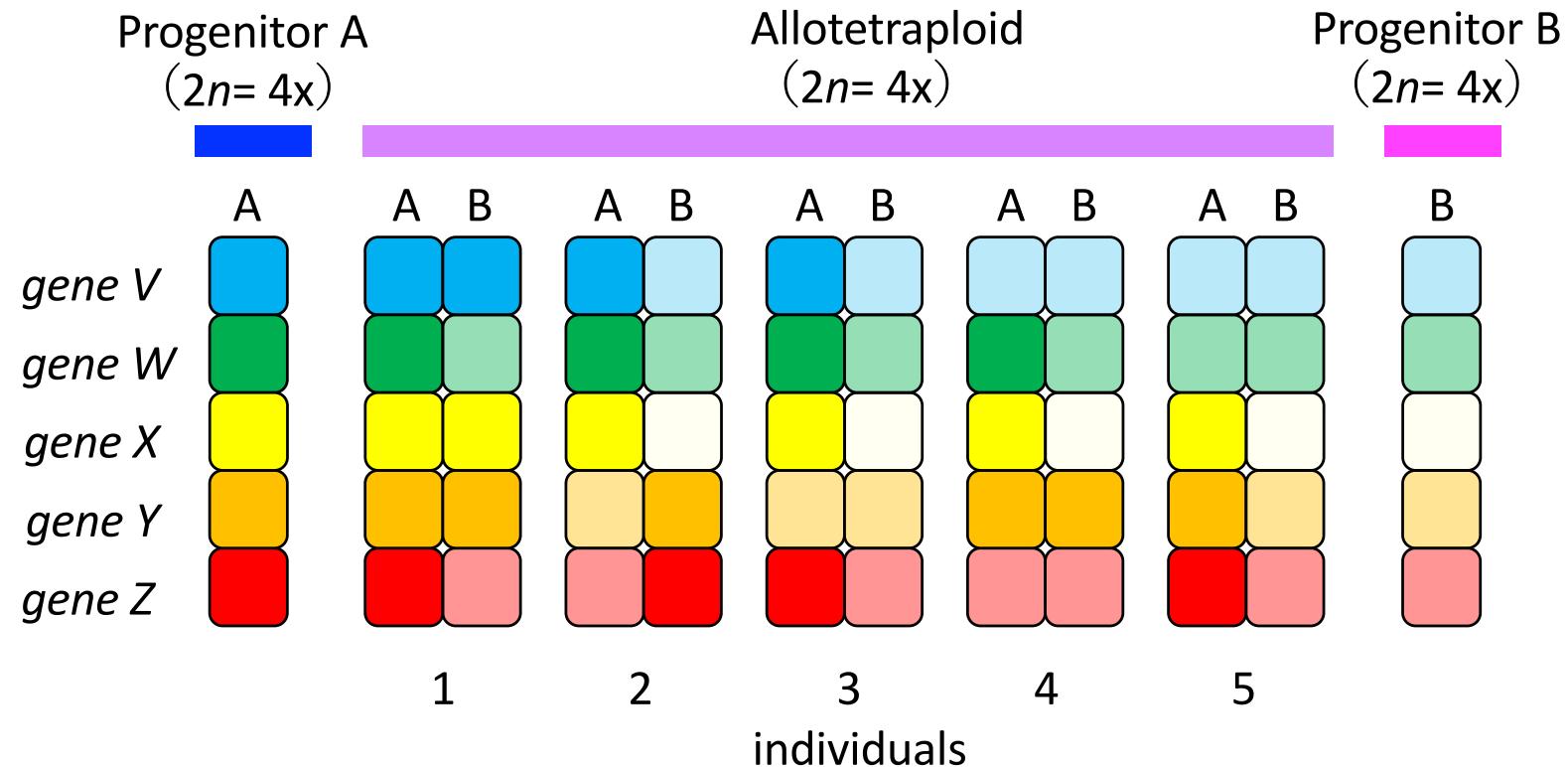
1-2 Billion years ago



## Ex. 3. Allopolyploidization (Whole Genome Duplication)



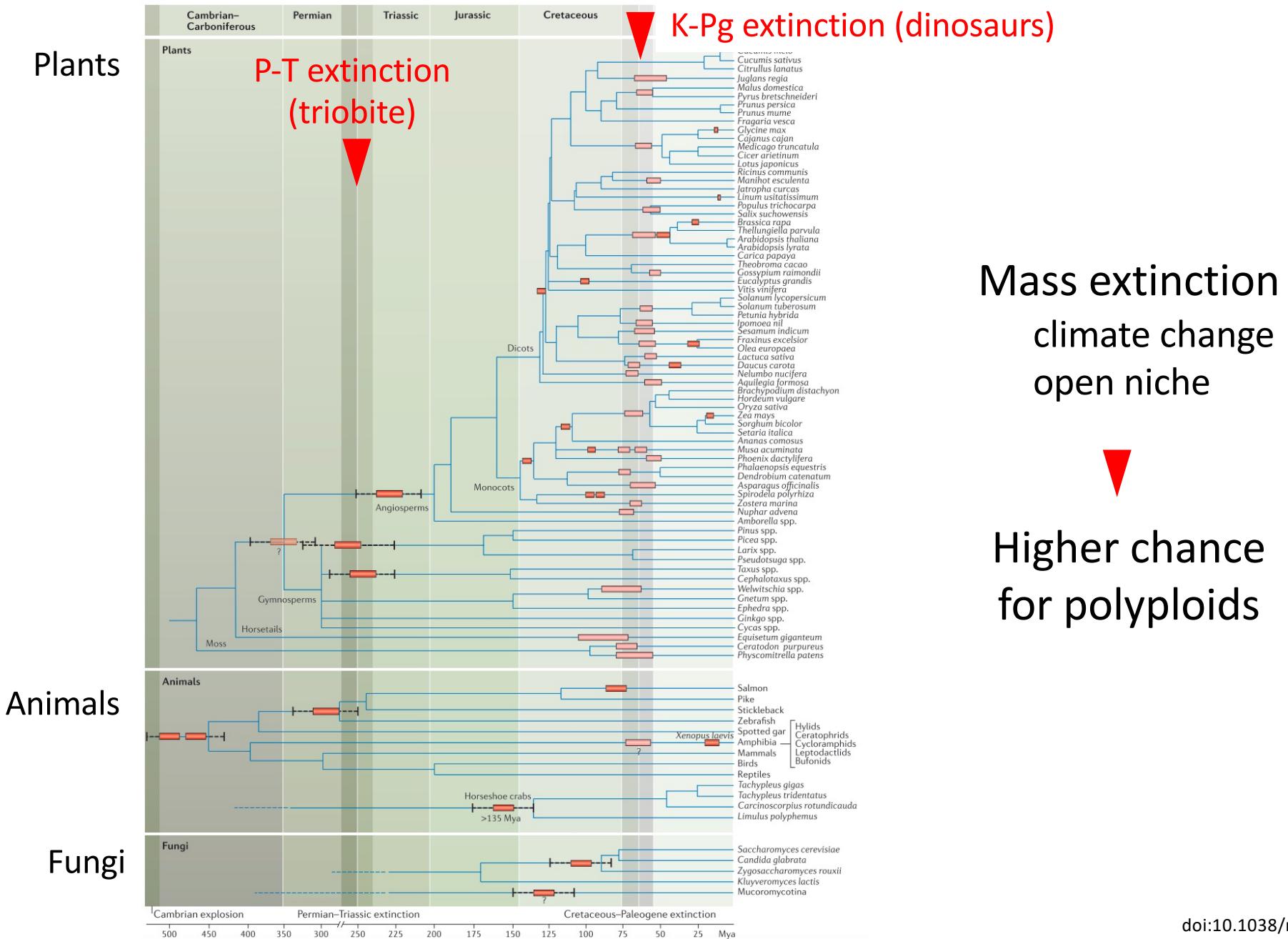
# Variety in transcriptome



New phenotypes  
Chance of more evolvability



# Polyploidization is so popular





# Many important crops are polyploid

hybrid vigor

larger fruit/seed

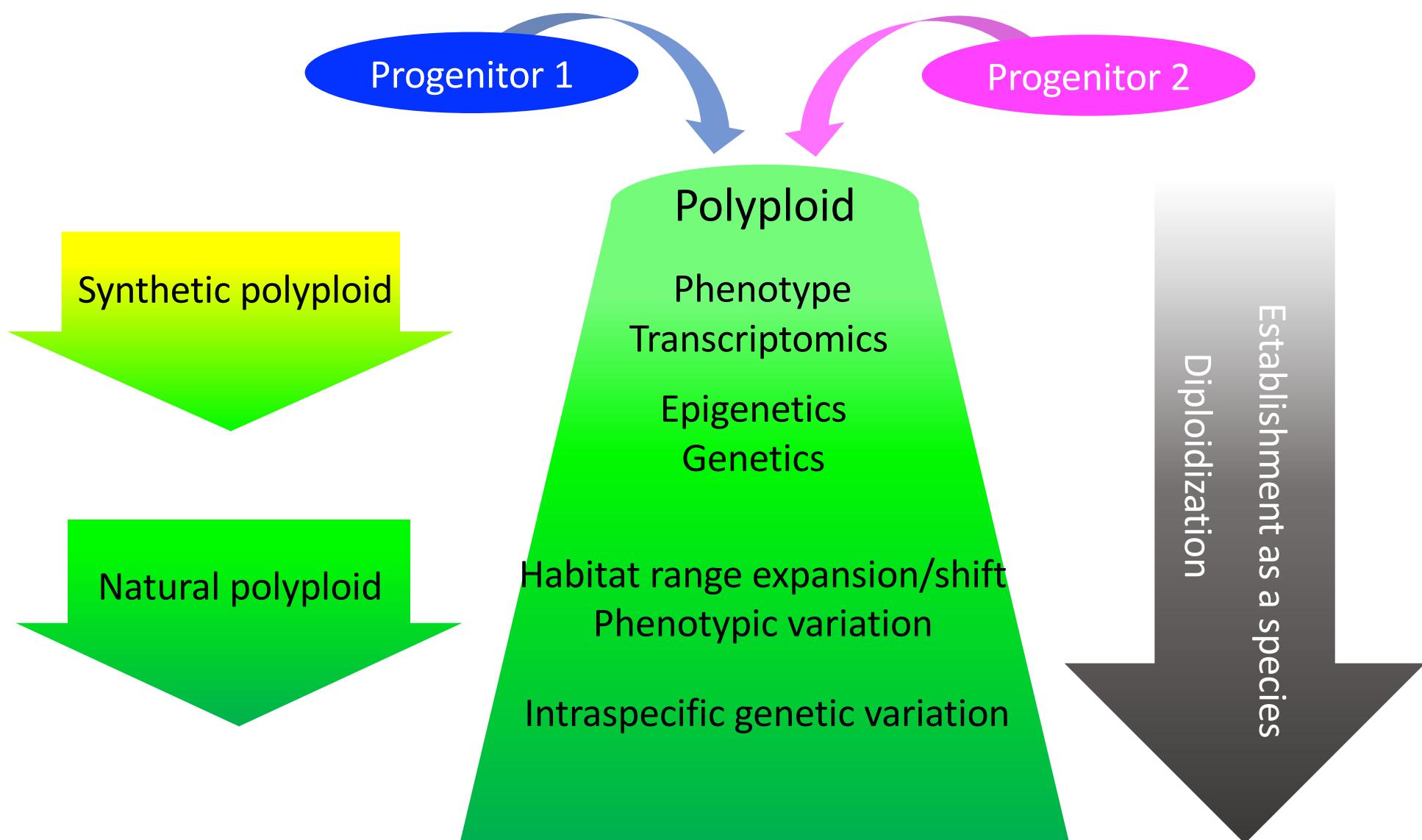
wider cultivated area



**Fig. 1.** A sample of agricultural crops that are polyploid, showing oil from oilseed rape (*Brassica napus*,  $2n = 4x = 38$ ), bread from bread wheat (*Triticum aestivum*,  $2n = 6x = 42$ ), rope from sisal (*Agave sisalana*,  $2n = 5x = 180$ ), coffee beans (*Coffea arabica*,  $2n = 4x = 44$ ), banana (*Musa* triploid hybrids,  $2n = 3x = 33$ ), cotton (*Gossypium hirsutum*,  $2n = 4x = 52$ ), potatoes (*Solanum tuberosum*,  $2n = 4x = 48$ ), and maize (*Zea mays*,  $2n = 4x = 20$ ).

doi:10.1126/science.1153585

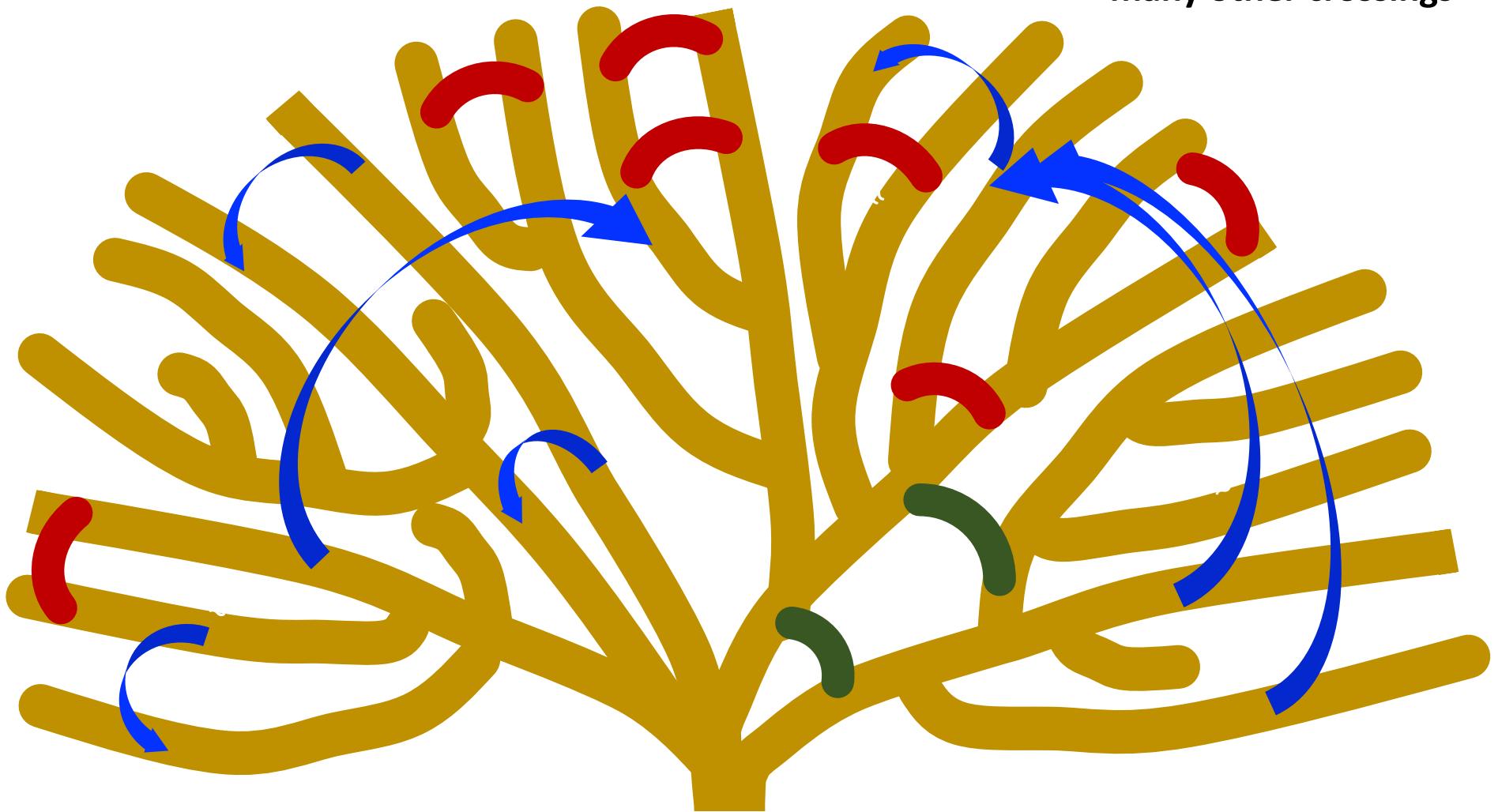
# My research interest: Ecological advantage of polyploid





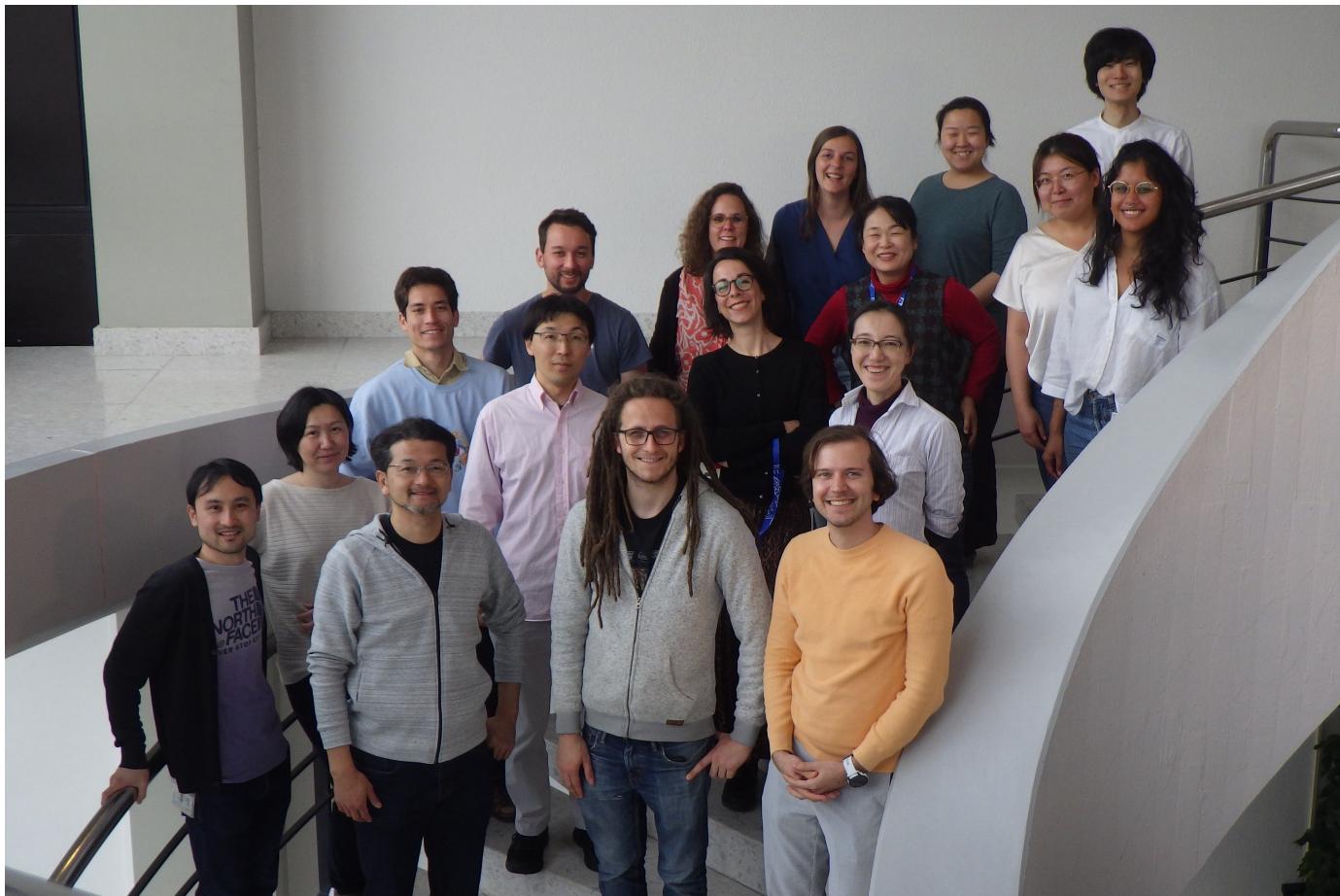
# Tree of Life? Network of Life!

**Endosymbiosis**  
**Horizontal Gene transfer**  
**Allopolyploidization**  
many other crossings





# Thanks for your attention



Members of  
Shimizu-Inatsugi & Shimizu groups