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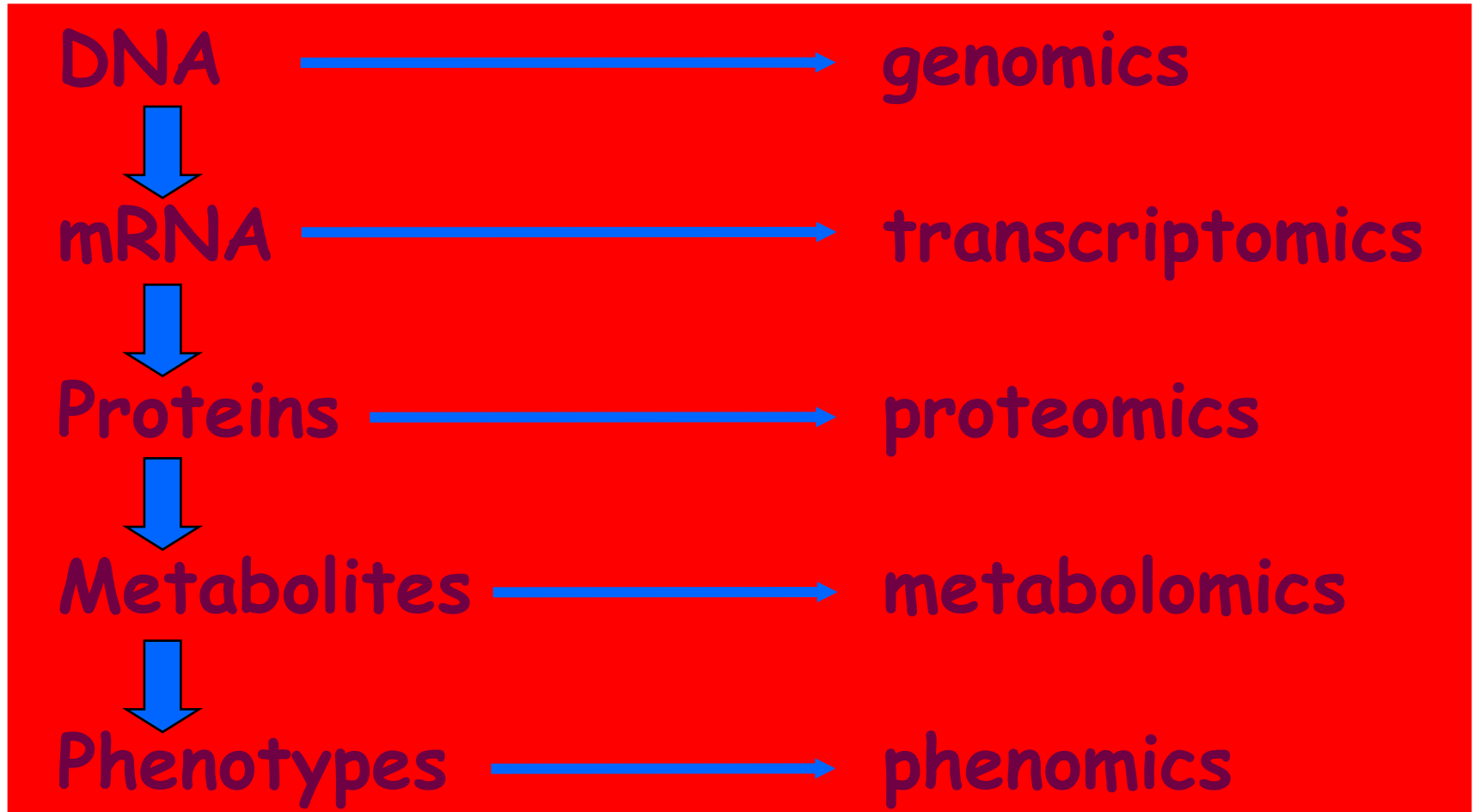
Genomica e alberi forestali

Michele Morgante
Roma, 30 maggio 2018



THE OMICS ERA

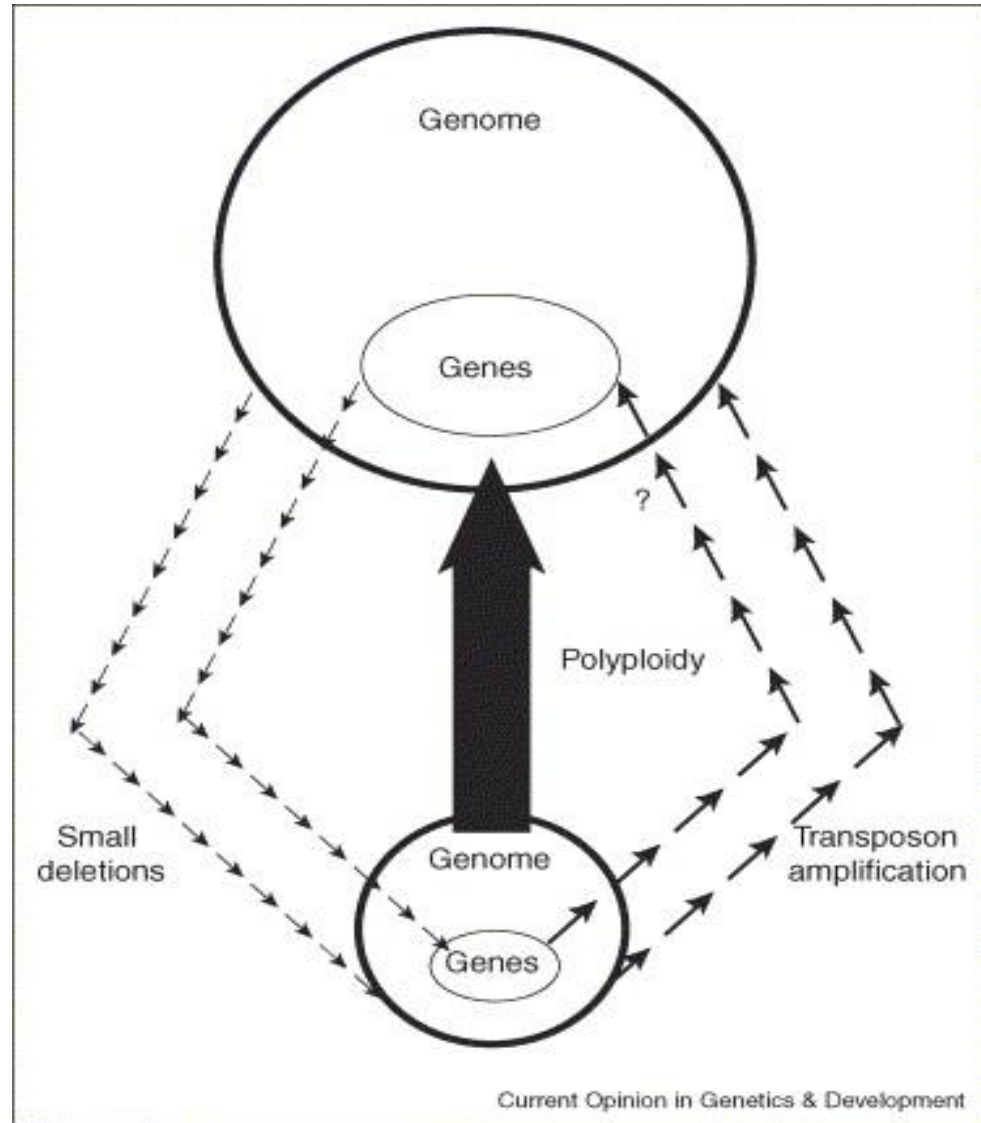
Omics Sciences



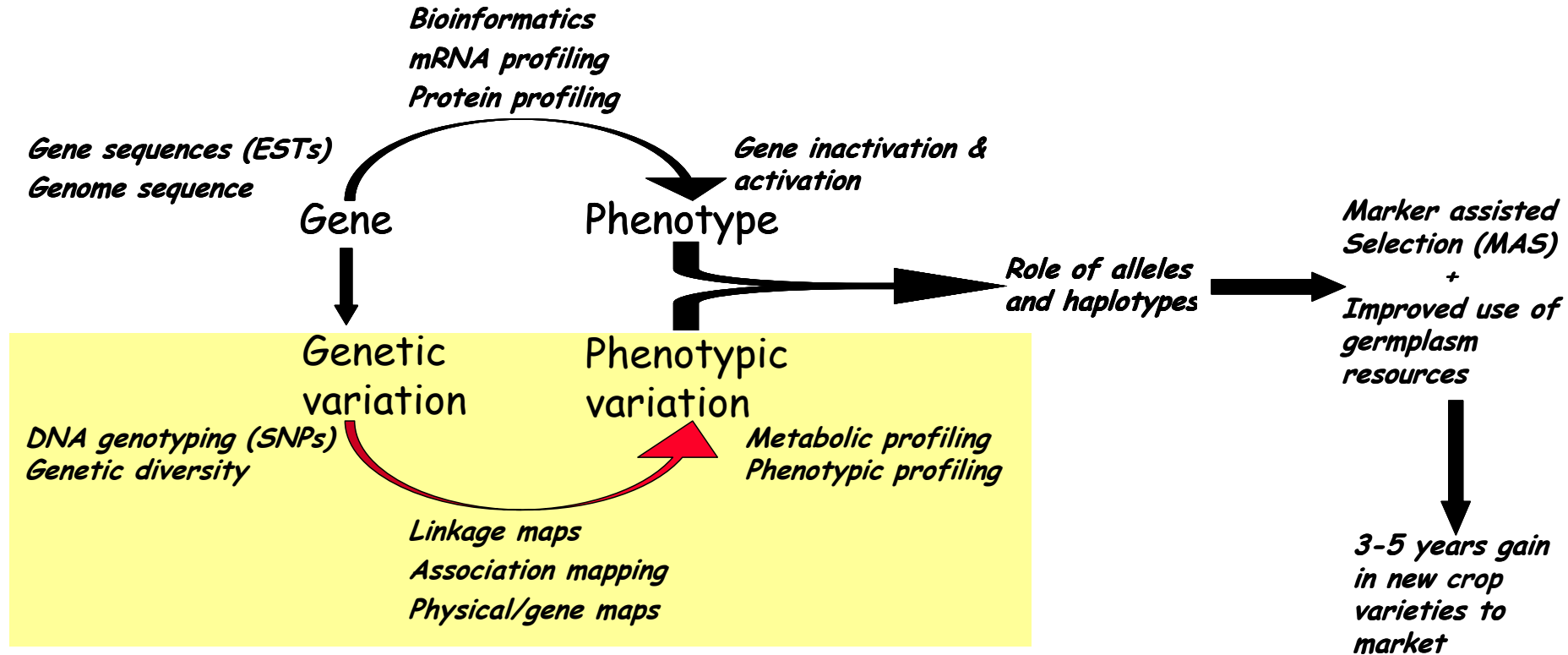
FOREST TREE GENOMES

- Angiosperms
 - Poplar
 - Chestnut
 - Oak
 - Cherry
- Gymnosperms
 - Spruce
 - Pine
- Very different genome history and organization
- Genomes to be redone entirely

GENOMIC VARIABILITY AMONG SPECIES



BREEDING MEETS GENES THROUGH GENOMICS: LINKING GENE AND PHENOTYPE VARIATION

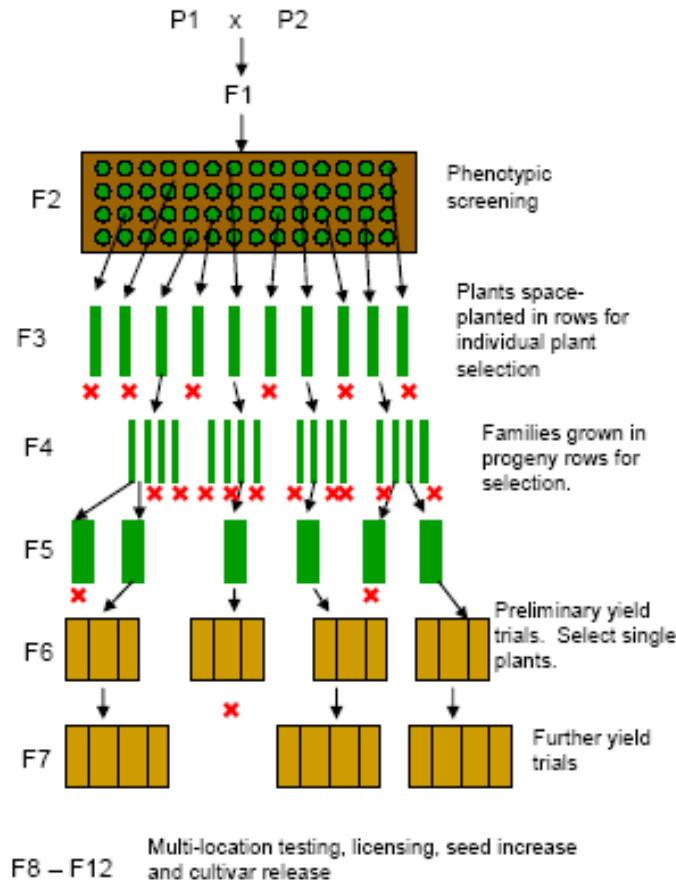


PLANT BREEDING AND GENOMICS: “MARKER-ASSISTED BREEDING”

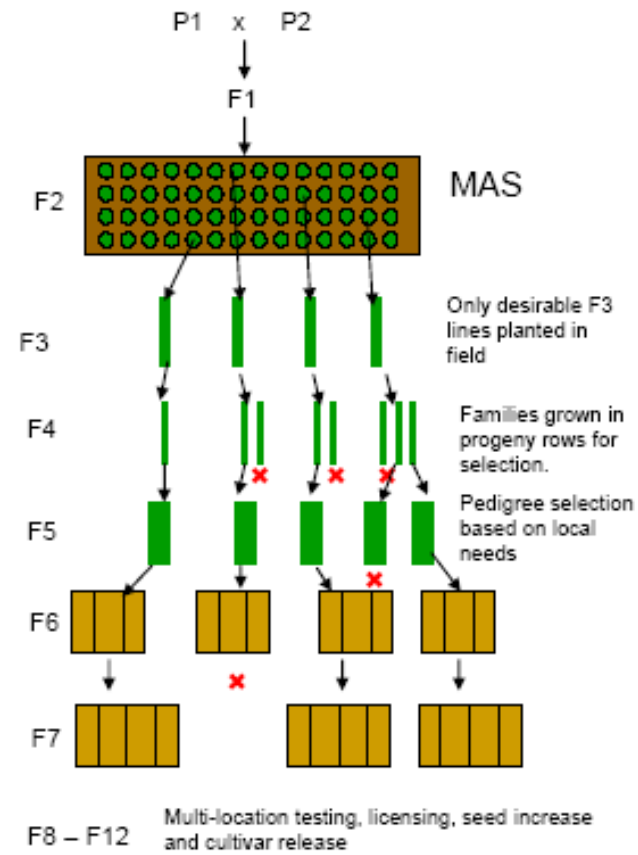
- Genetic analysis allows the identification of genes controlling the traits of interest
 - Genomics provides genes and markers
 - Quantitative traits can be dissected into single genes
- Selection methods can be devised that are based on the genotype and not on the phenotype
 - Marker assisted selection
 - Genomic selection
 - Selection process efficiency increases

PLANT BREEDING AND “MARKER ASSISTED SELECTION”

PEDIGREE METHOD

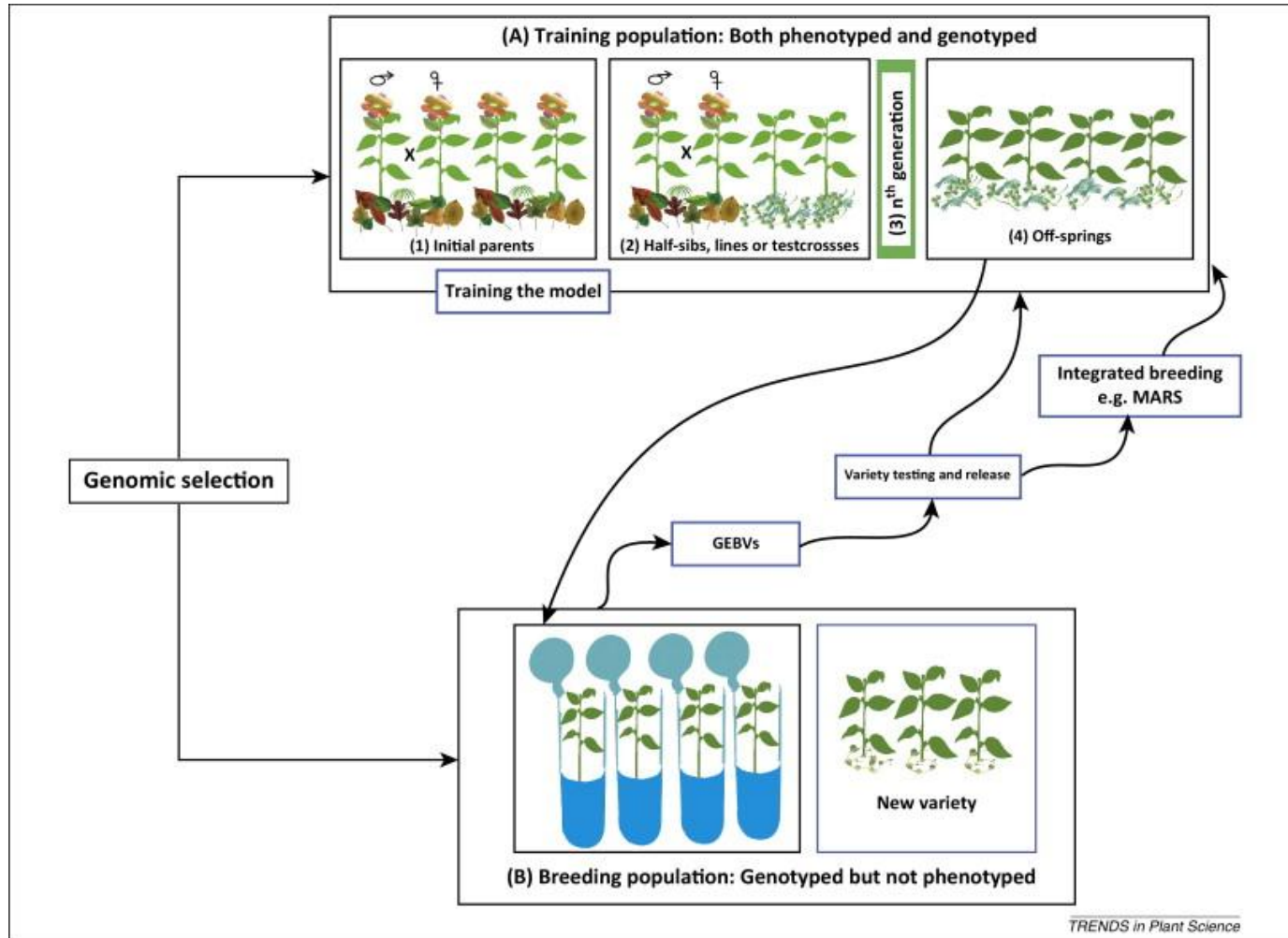


EARLY GENERATION SELECTION MARKER ASSISTED SELECTION



Phenotypic selection is replaced by genotypic selection based on the knowledge of the location of trait controlling genes

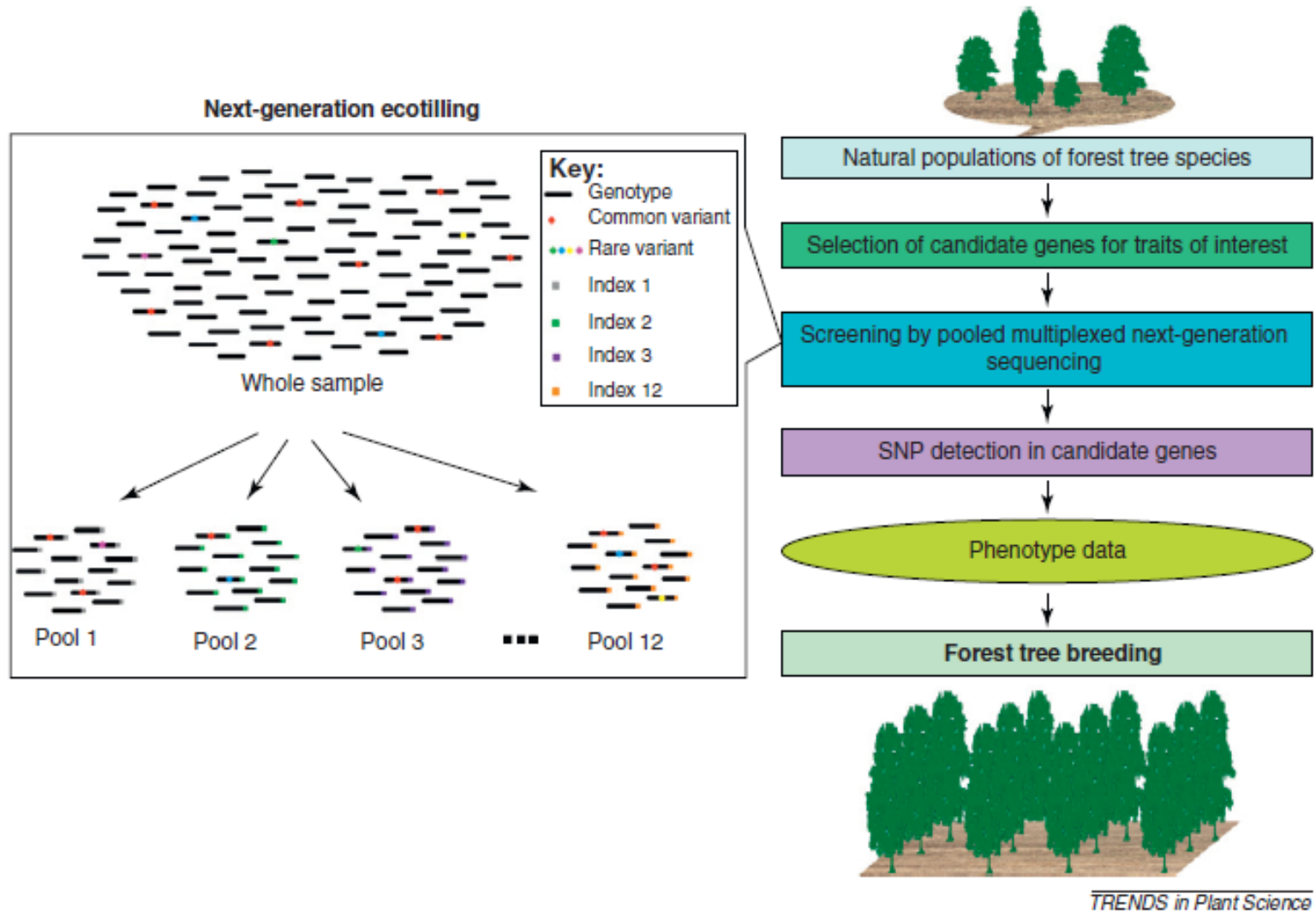
PLANT BREEDING AND “GENOMIC SELECTION”: NEW TECHNOLOGIES



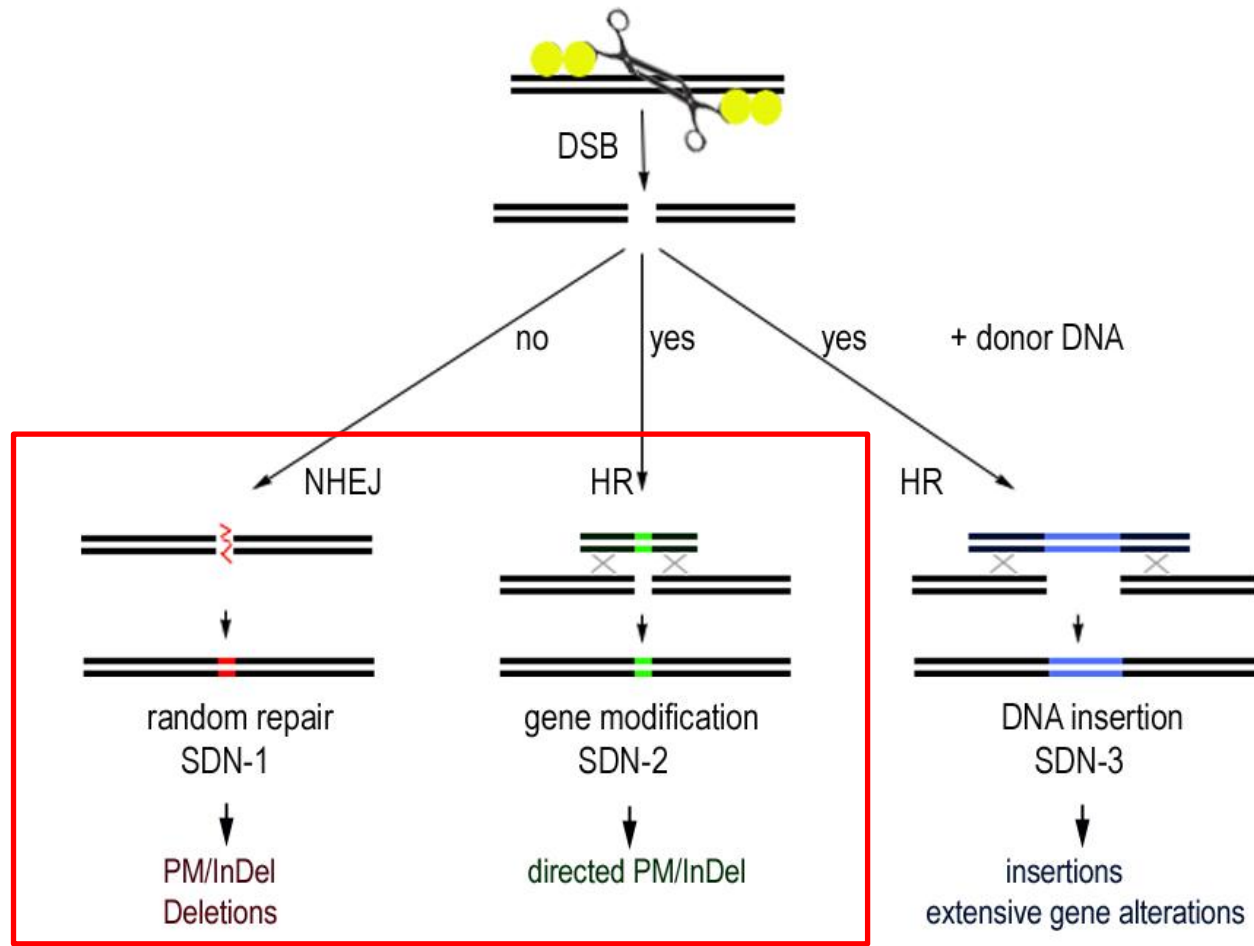
PLANT BREEDING AND GENOMICS: TARGETED MODIFICATIONS

- Genetic analysis allows the identification of genes controlling the traits of interest
 - Genomics provides genes and markers
 - Quantitative traits can be dissected into single genes
- We can develop methods for genetic modifications targeted to specific genes and nucleotides
 - Process efficiency increase

FINDING USEFUL VARIATION

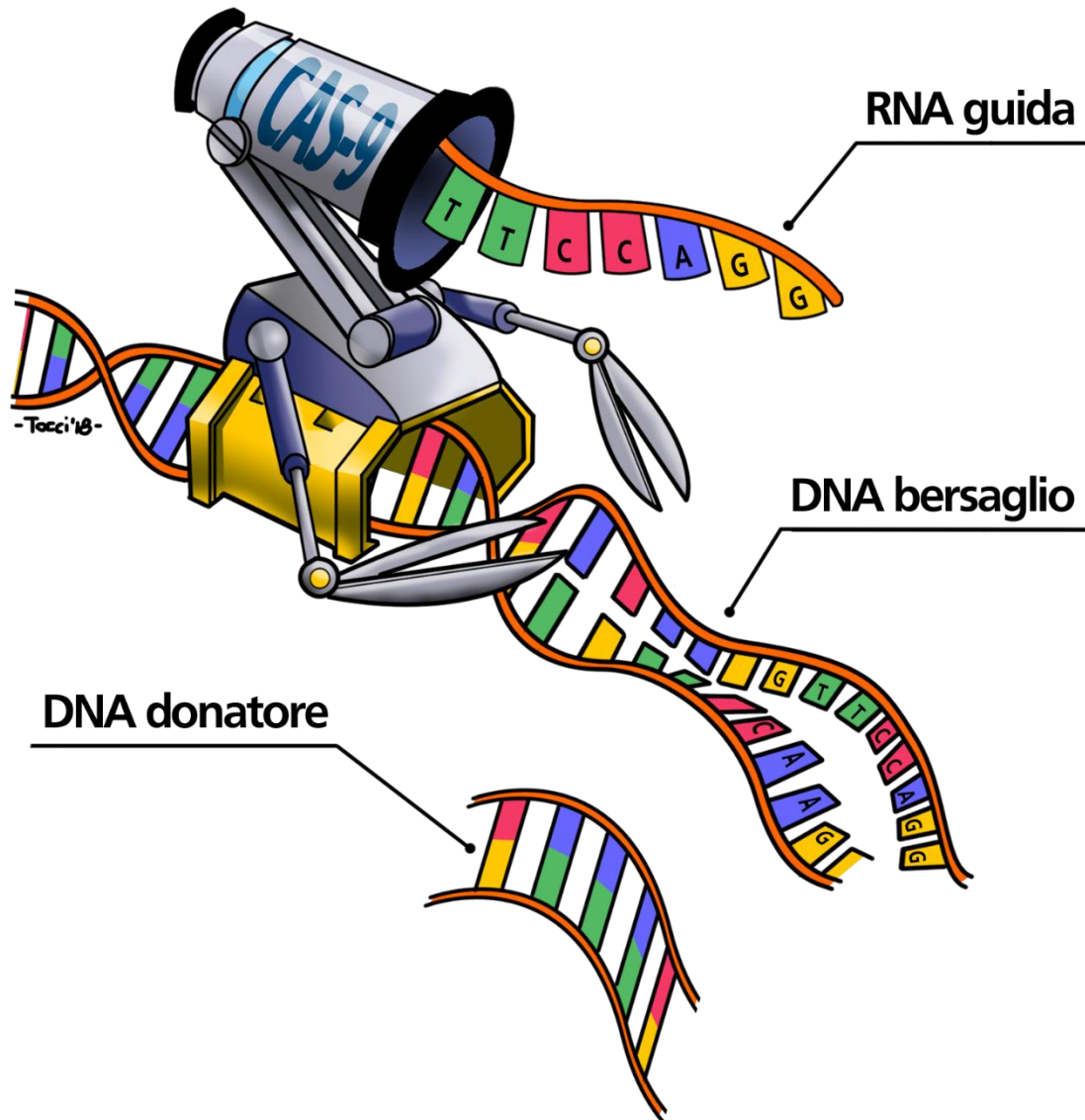


PLANT BREEDING AND “GENOME EDITING”: NEW TECHNOLOGIES



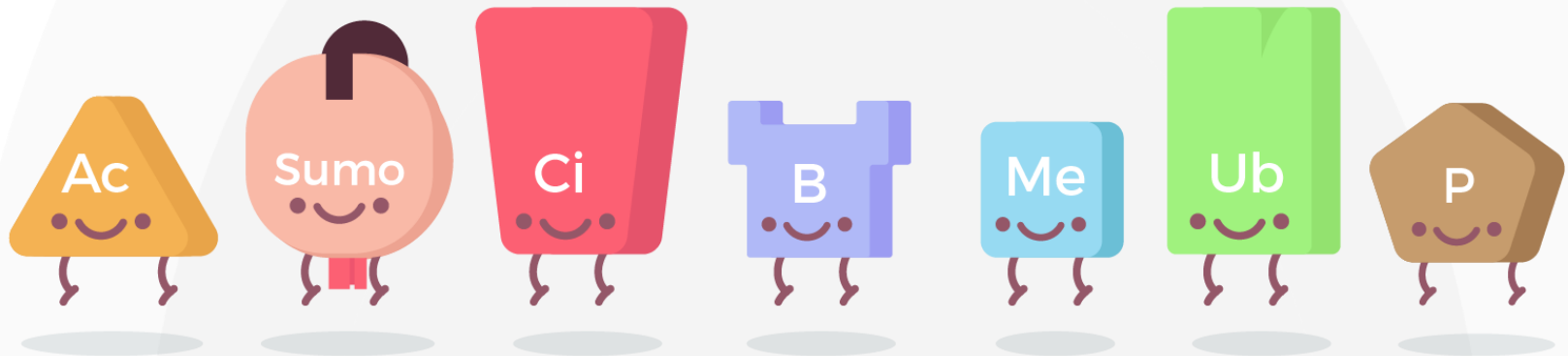
Targeted modifications identical to spontaneous mutations

CRISPR/CAS: RNA-DIRECTED NUCLEASE



Epigenetic modifications

DNA and histons undergo epigenetic modifications: these are chemical modifications that act as signals to read or not to read DNA

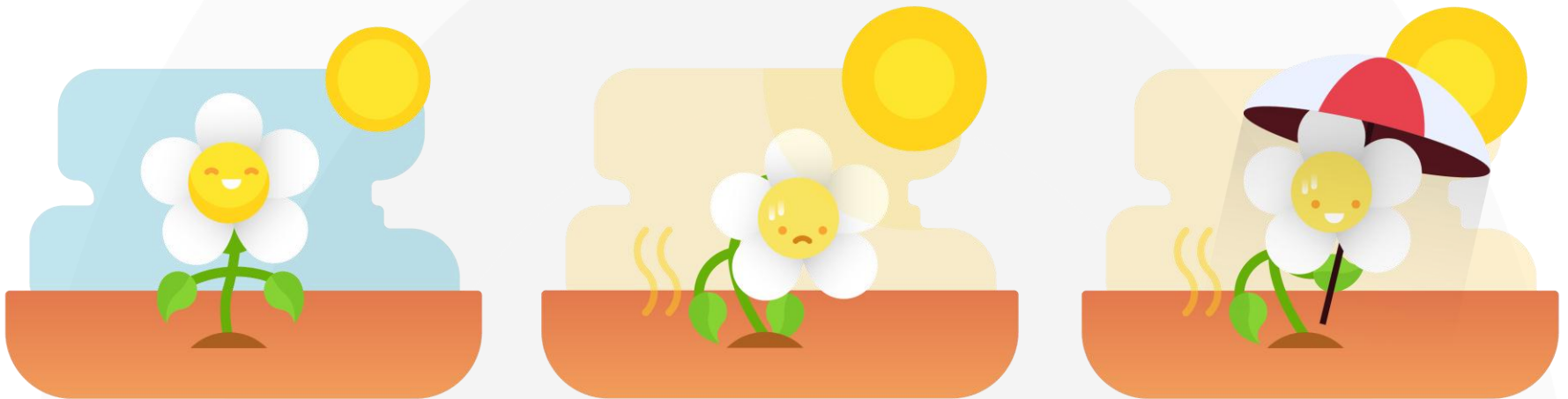


Epigenetic variation is induced by the environment

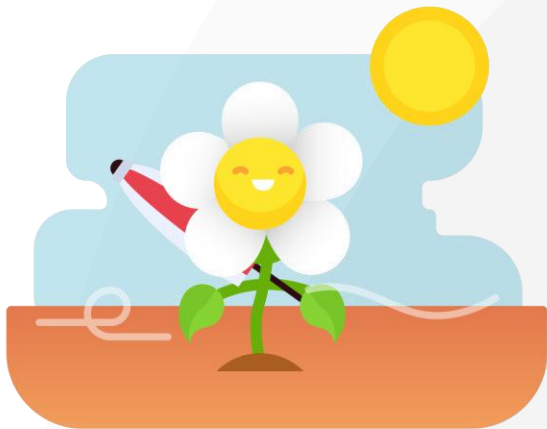
The epigenome activates and inactivates genomic regions in response to the environmental conditions



Stress memory in plants



Stress memory in plants (2)



A comeback of Lamarckian concepts?

