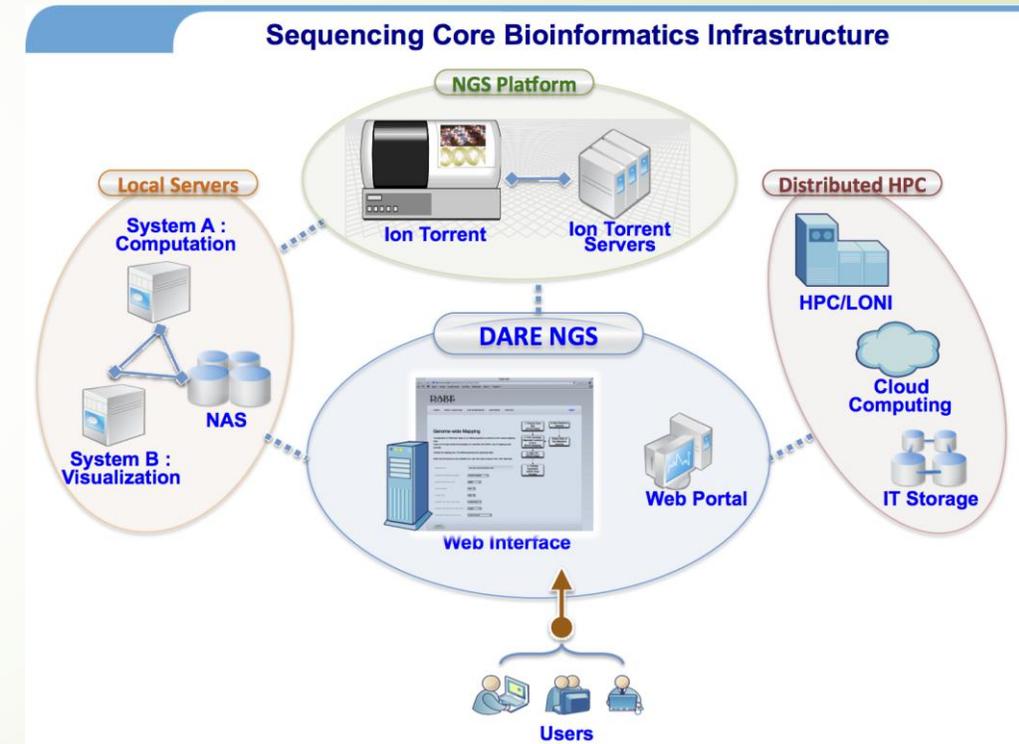




Next-Generation Sequencing  
(NGS) technologies contribute  
to agriculture – role of bio-  
informatics

# Next-Generation Sequencing (NGS)

- NGS introduced high efficiency in terms of experimental execution, time and a deeper resolution
- Stimulate an unexpected interest from scientists due to the higher affordability in terms of experimental procedures and economical requirements



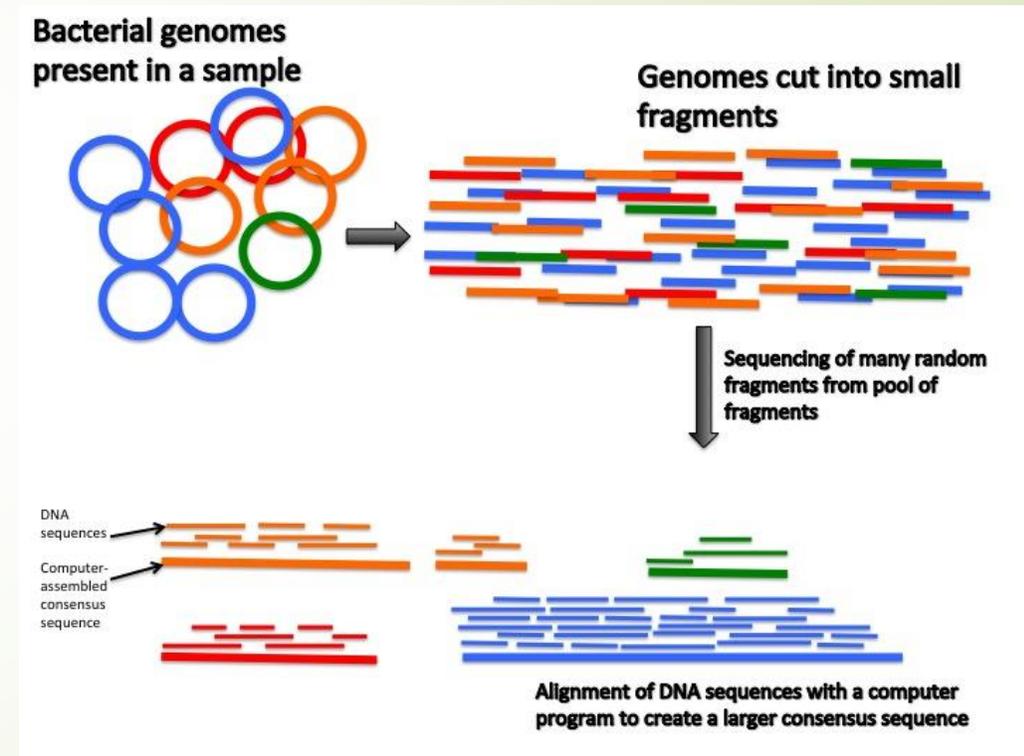


# Single and multi species genomics for agriculture

- ▶ Plant omics studies derive from:
  - ▶ one individual - the organization and the functionality of specific cells, tissues, or organs are investigated, mainly to identify factors influencing properties, like the quality and the shape
  - ▶ Several individuals of a species (a population) – understanding of evolutionary processes influencing genetic variability
  - ▶ Multiple species (a community) – metagenomics, aims to describe the prokaryotic component of the community, but is useful to trace the different eukaryotes existing in a specific environment

# Impact of NGS in agriculture

- ▶ “Agricultural genomics” (agri-genomics) - find innovative solutions through the study of crops or livestock genomes
- ▶ Study of plant, soil, and livestock microbiome - a key role in agriculture
- ▶ Metagenome sequencing methods - profiling microbial communities and describe their main functional features through whole DNA extraction and the use of NGS on the entire sample





# Impact of NGS in agriculture

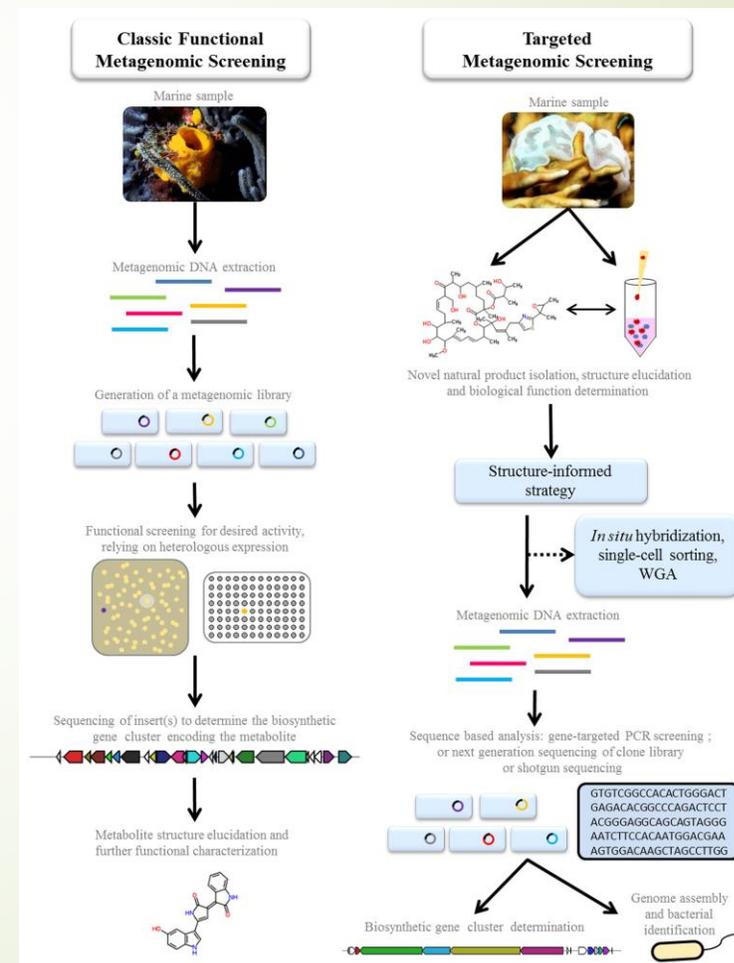
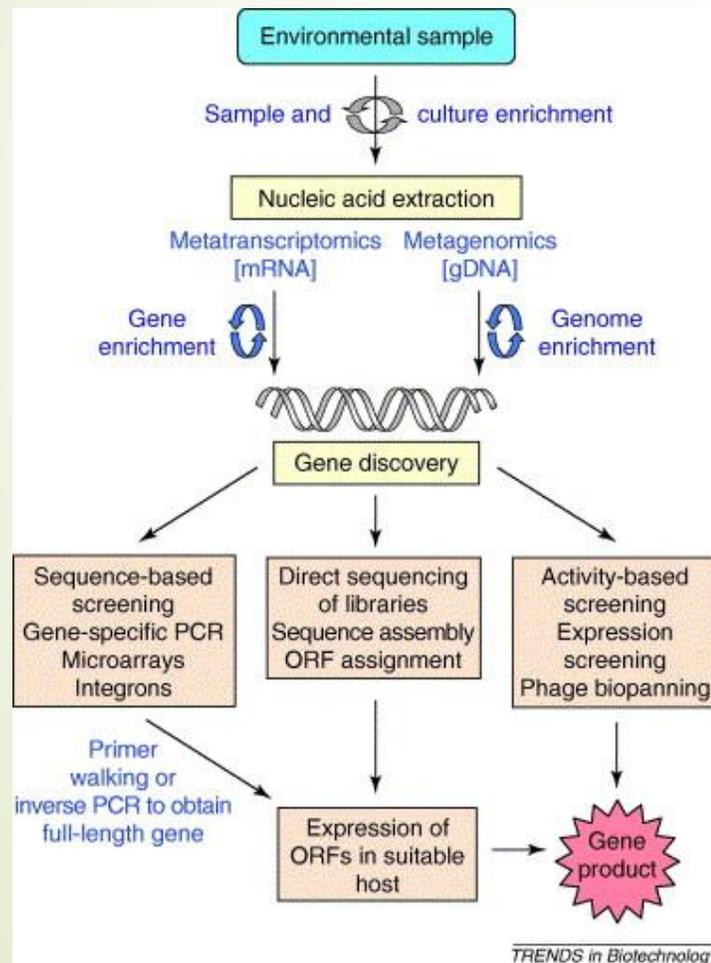
- ▶ Agri-genomics - appropriate for depicting the complex patterns of interactions occurring among microorganisms in soil and in plant rhizosphere
- ▶ Agri-genomics - useful to trace the shift in taxonomic composition and functional redundancy of microbial communities in rhizosphere and in soil in connection to environmental changes associated to fertilization and agricultural management.
- ▶ Agri-genomics - deciphering the role of soil bacteria in plant nutrition or in the cycle of the elements
- ▶ Discovery of new genes, bio-products, plant growth promoting microorganisms consortia



# Omics approaches impacted bioinformatics

- ▶ Push forward the genome sequencing of model and non-model species of agriculture interest
  - ▶ Transcriptome sequencing - support of gene prediction, depict transcriptional processes and define cell functionality in physiological, pathological, or stress conditions
  - ▶ Analysis of genome variations based on single nucleotide polymorphisms (SNP) discovery
  - ▶ Studying genomic structure of the community – target-based and shot-gun approaches
- 

# Omics approaches impacted bioinformatics



# NGS bioinformatics contribution to agriculture

- ▶ NGS bioinformatics era is revolutionizing the experimental design in molecular biology, contributing in increasing scientific knowledge while impacting relevant applications in agriculture
- ▶ The different NGS bioinformatics applications:
  - ▶ Provide relevant scientific knowledge based on their specificities
  - ▶ Are fundamental for translational approaches
  - ▶ Provide contributions with technological innovation, novel products, predictive and monitoring approaches
  - ▶ Support innovative applications for crop and livestock management

