

# **Transcriptomic profiling of *B. phytofirmans* PsJN colonizing potato plants in response to host plant drought stress**

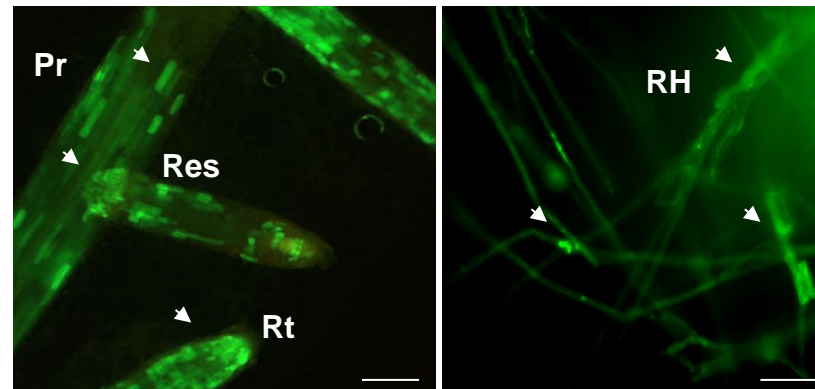
Raheleh Sheibani-Tezerji, Thomas Rattei, Friederike Trognitz, Angela Sessitsch, and Birgit Mitter

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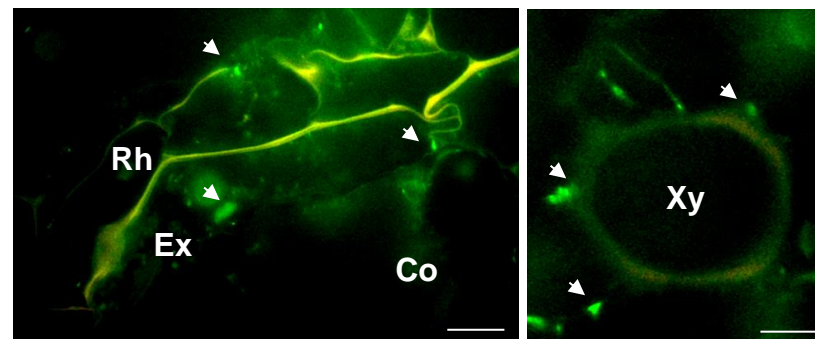
## *Burkholderia phytofirmans* PsJN

- one of the best studied bacterial endophyte
- establishes rhizosphere and endophytic populations in a variety of plants
- potato, tomato, pepper, tobacco, sugar beet, maize, barley, wheat, ...

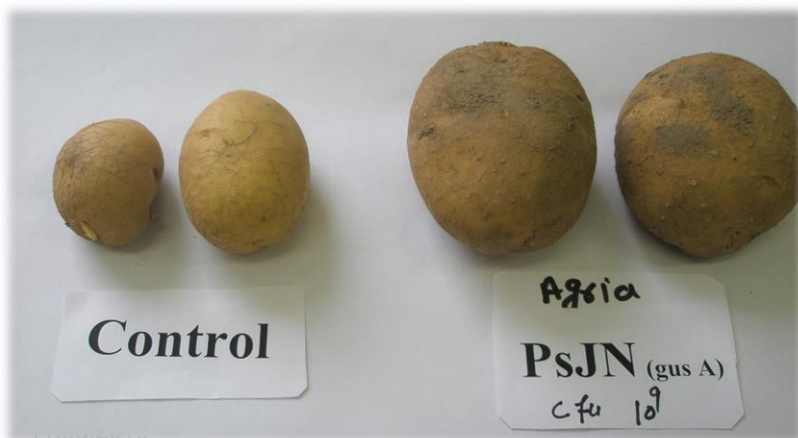
Root surfaces



Endorhiza

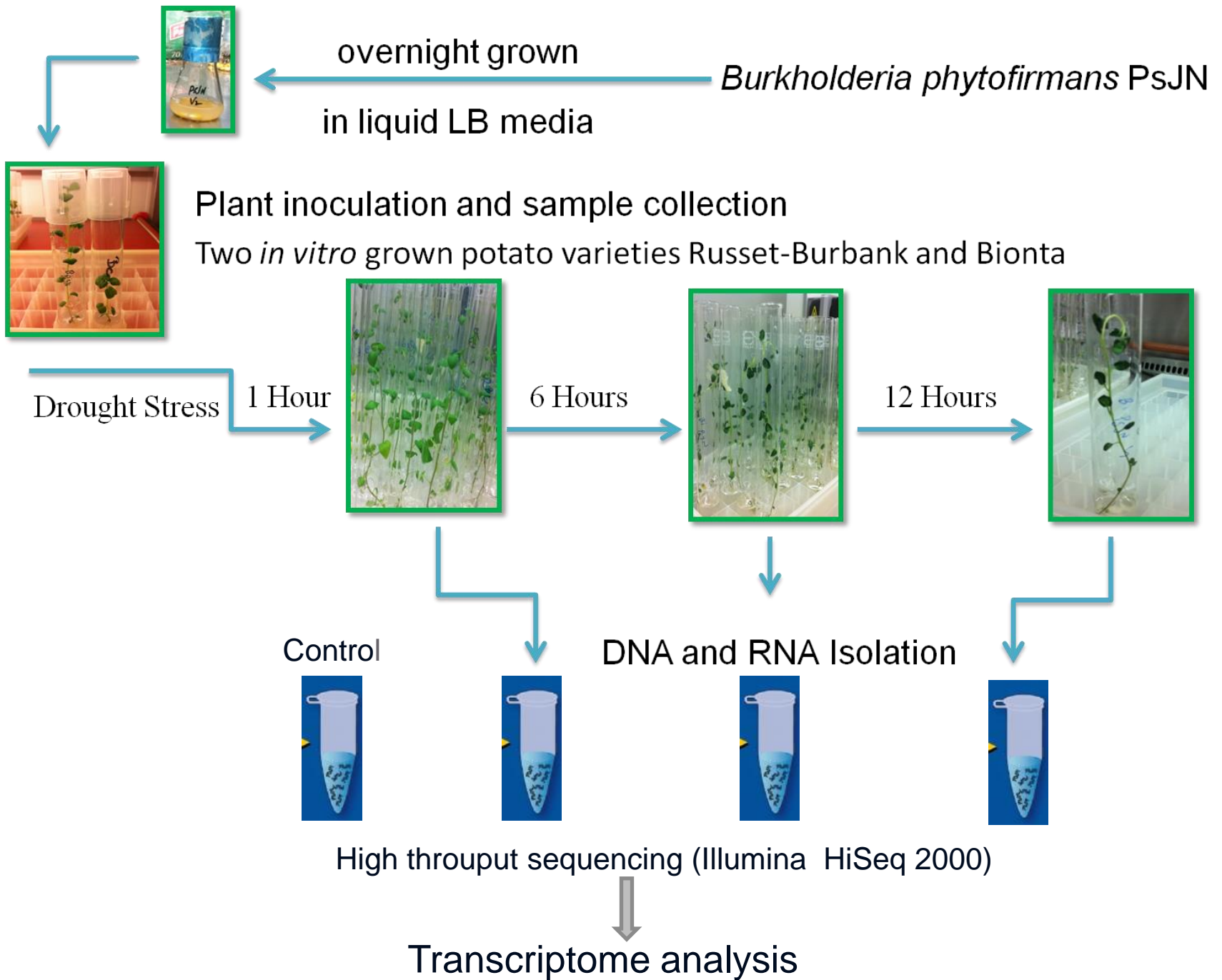


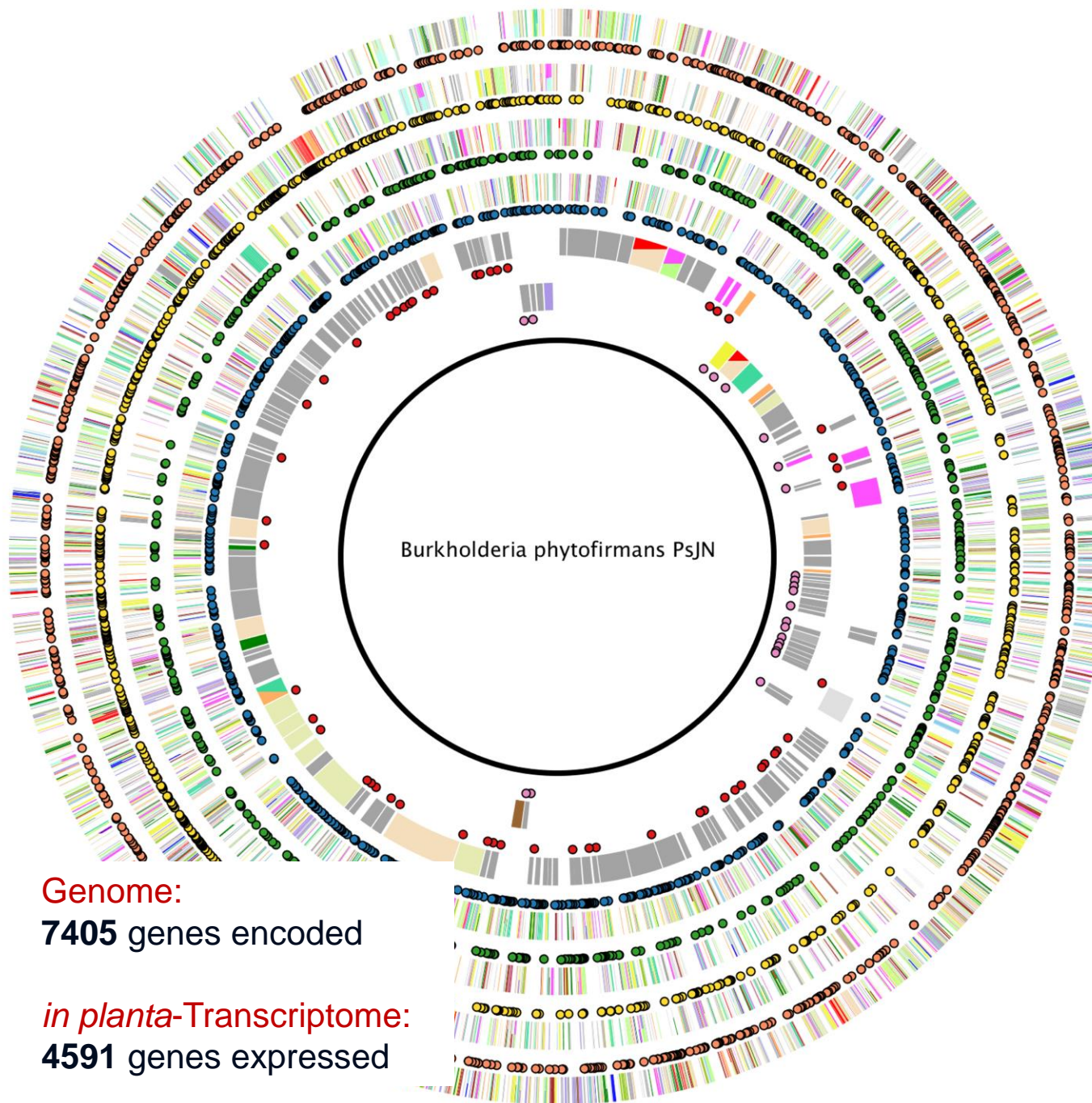
Photocredit:  
Stéphane Compant





Naveed et al., 2014. Environmental and Experimental Botany 97: 30– 39.





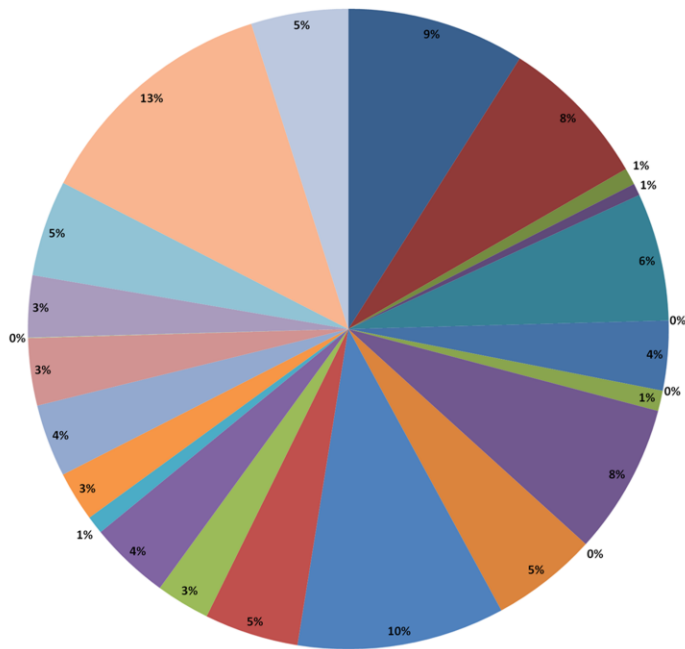
- Circular map legend**
- Ring 1: ORFs plus strand: Chr+1  
*Burkholderia phytofirmans* PsJN
  - Ring 2: Genomic Elements: Chr+1\_exp\_control\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 3: ORFs minus strand: Chr-1  
*Burkholderia phytofirmans* PsJN
  - Ring 4: Genomic Elements: Chr-1\_exp\_control\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 5: ORFs plus strand: Chr+2  
*Burkholderia phytofirmans* PsJN
  - Ring 6: Genomic Elements: Chr+2\_exp\_control\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 7: ORFs minus strand: Chr-2  
*Burkholderia phytofirmans* PsJN
  - Ring 8: Genomic Elements: Chr-2\_exp\_control\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 9: ORFs plus strand: Plasmid  
*Burkholderia phytofirmans* PsJN
  - Ring 10: Genomic Elements: Plasmid\_plus\_con\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 11: ORFs minus strand: Plasmid  
*Burkholderia phytofirmans* PsJN
  - Ring 12: Genomic Elements: Plasmid\_minus\_con\_PsJN  
*Burkholderia phytofirmans* PsJN
  - Ring 13: Background shade  
*Burkholderia phytofirmans* PsJN
  - Ring 14: text  
*Burkholderia phytofirmans* PsJN
- COG categories**
- Translation, ribosomal structure and biogenesis
  - RNA processing and modification
  - Transcription
  - Replication, recombination and repair
  - Chromatin structure and dynamics
  - Cell cycle control, cell division, chromosome partitioning
  - Nuclear structure
  - Defense mechanisms
  - Signal transduction mechanisms
  - Cell wall/membrane/envelope biogenesis
  - Cell motility
  - Cytoskeleton
  - Extracellular structures
  - Intracellular trafficking, secretion, and vesicular transport
  - Posttranslational modification, protein turnover, chaperones
  - Energy production and conversion
  - Carbohydrate transport and metabolism
  - Amino acid transport and metabolism
  - Nucleotide transport and metabolism
  - Coenzyme transport and metabolism
  - Lipid transport and metabolism
  - Inorganic ion transport and metabolism
  - Secondary metabolites biosynthesis, transport and catabolism
  - General function prediction only
  - Function unknown

**Genome:**  
7405 genes encoded

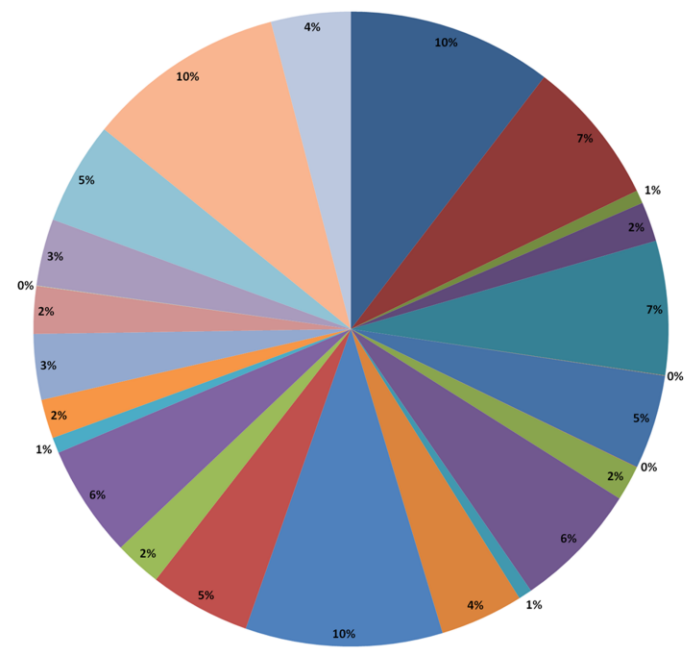
**in planta-Transcriptome:**  
4591 genes expressed

# Transcriptomic profile of *B. phytofirmans* PsJN in potato plants: Transcriptome vs Genome

% of total COGs in PsJN Transcriptome



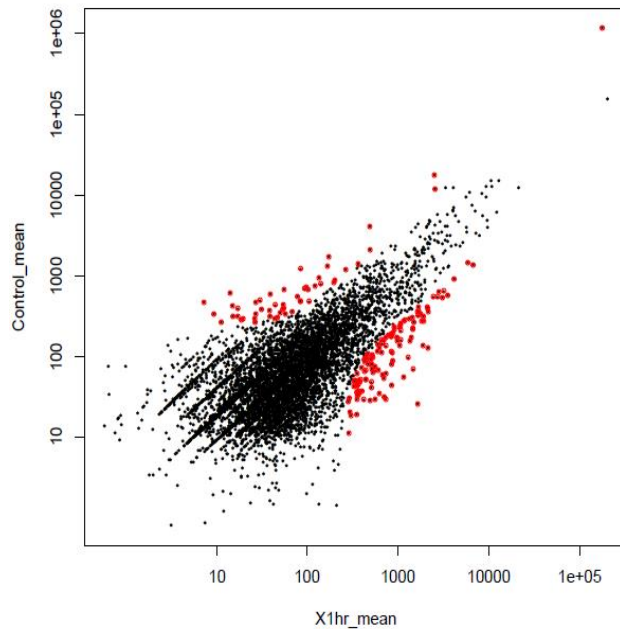
% of total COGs in PsJN genome



- Amino acid transport and metabolism
- Carbohydrate transport and metabolism
- Cell cycle control, cell division, chromosome partitioning
- Cell motility
- Cell wall/membrane/envelope biogenesis
- Chromatin structure and dynamics
- Coenzyme transport and metabolism
- Cytoskeleton
- Defense mechanisms
- Energy production and conversion
- Extracellular structures
- Function unknown
- General function prediction only
- Inorganic ion transport and metabolism
- Intracellular trafficking, secretion, and vesicular transport
- Lipid transport and metabolism
- Mobilome: prophages, transposons
- Nucleotide transport and metabolism
- Posttranslational modification, protein turnover, chaperones
- Replication, recombination and repair
- RNA processing and modification
- Secondary metabolites biosynthesis, transport and catabolism
- Signal transduction mechanisms
- Transcription
- Translation, ribosomal structure and biogenesis

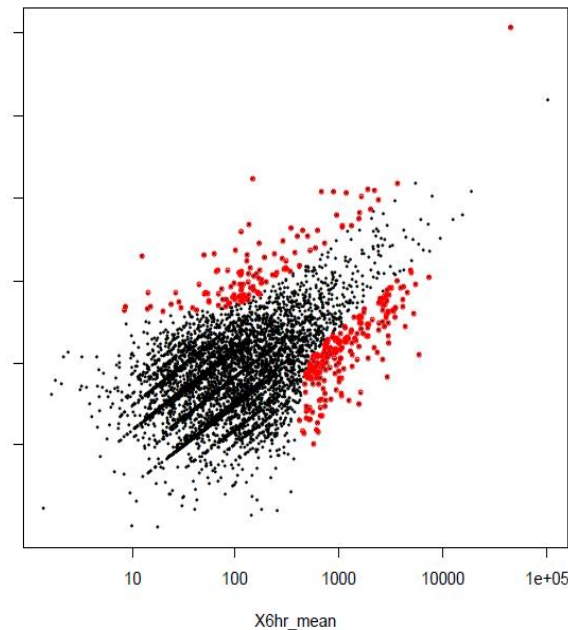
# Transcriptional response of PsJN to plant drought stress

**1h**



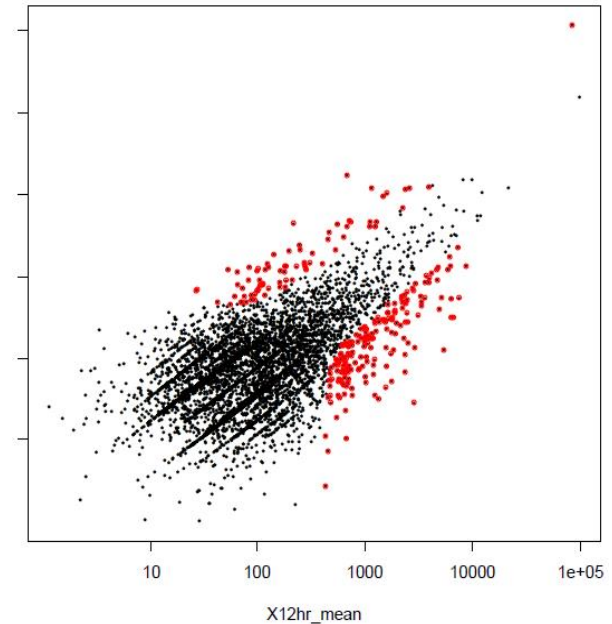
**DEG: 194, down: 57,  
up: 137**

**6h**



**DEG: 354, down: 125,  
up: 229**

**12h**



**DEG: 266, down: 81,  
up: 185**



# Transcriptional response of PsJN to plant drought stress

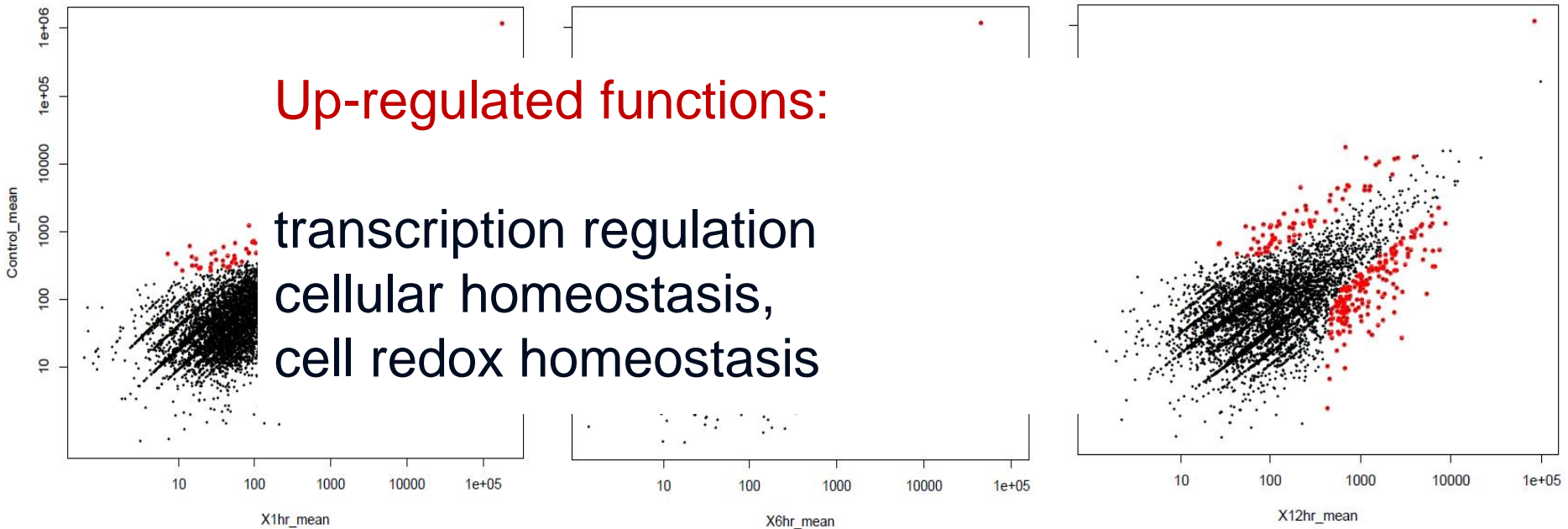
1h

6h

12h

Up-regulated functions:

transcription regulation  
cellular homeostasis,  
cell redox homeostasis

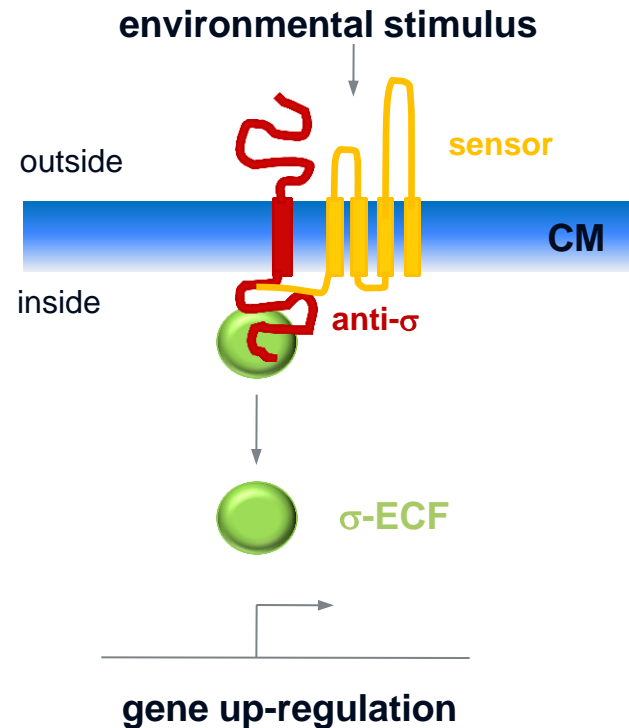


**DEG: 194, down: 57,  
up: 137**

**DEG: 354, down: 125,  
up: 229**

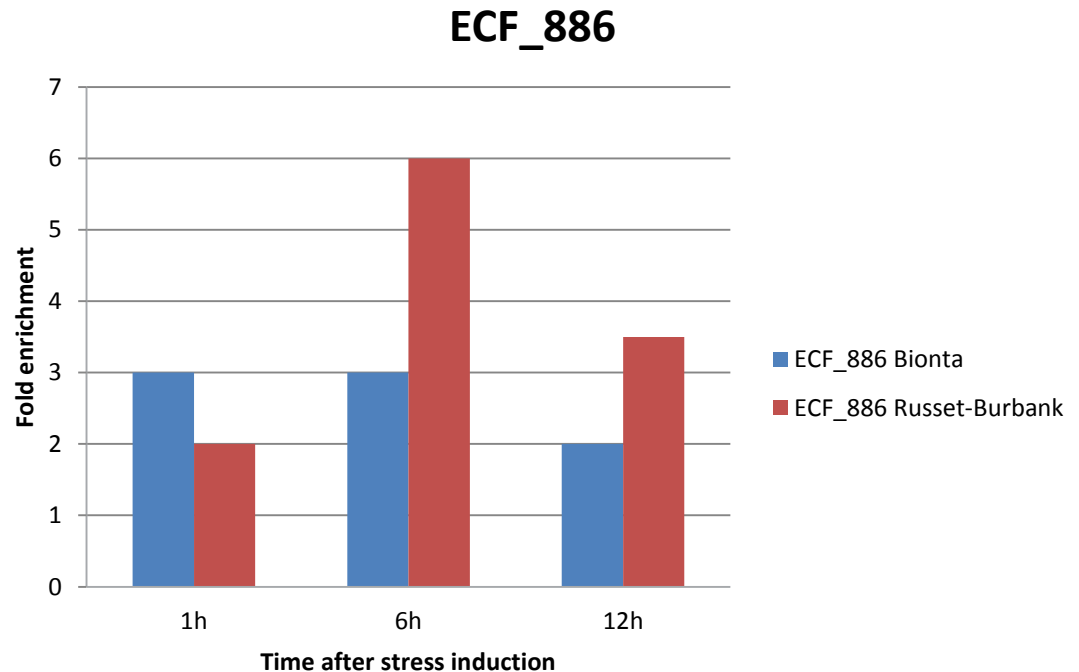
**DEG: 266, down: 81,  
up: 185**

# Extracytoplasmatic function sigma factor – cell surface signaling



# ECF sigma factor genes in *B. phytofirmans* PsJN colonizing potato plants

- PsJN encodes 17 ECF sigma factor genes
- 6 ECF sigma factor genes were expressed
- Differences in ECF sigma factor gene expression in Bionta and Russet-Burbank
- 1 ECF sigma factor was induced upon drought stress
- stronger response in Russet-Burbank than in Bionta



## Summary and Conclusions

- ***B. phytofirmans* PsJN is active inside plants:** 4591/7405 were expressed in PsJN colonizing *in-vitro* potato plants cv. Bionta
- Distribution of COGs in the transcriptome of PsJN colonizing *in-vitro* potato plants cv. Bionta is similar to that in the genome
- ***B. phytofirmans* PsJN “feels” plant stress:** gene expression in strain PsJN was affected by plant drought stress
- Genetic response resembles oxidative stress response
- ECF sigma factors are expressed in PsJN colonizing *in-vitro* potato plants cv. Bionta and Russet-Burbank – plant cultivar specific differences
- One ECF sigma factor is induced in response plant stress induction

**THANK YOU!**

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Thomas Rattei (University of Vienna)

Friederike Trognitz and Angela Sessitsch (AIT)