PsANT, the adenine nucleotide translocase of *Puccinia striiformis*, promotes cell death and fungal growth

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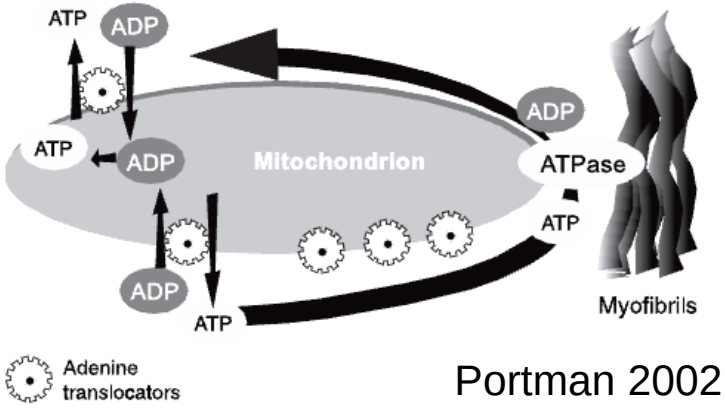
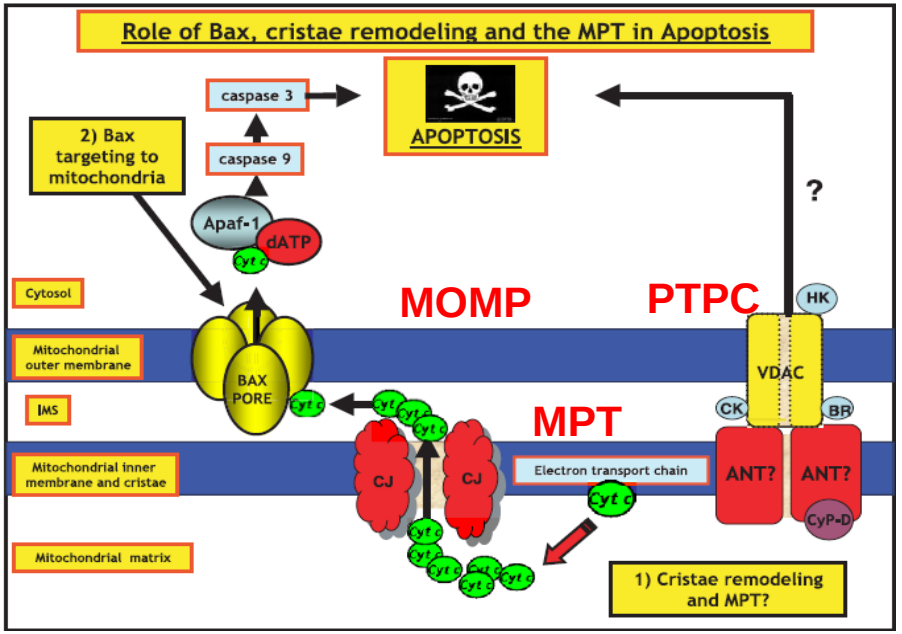
Adenine nucleotide translocase (ANT)

- **ANT is responsible for ADP/ATP exchange.**
- **An important component in apoptosis.**



Portman 2002



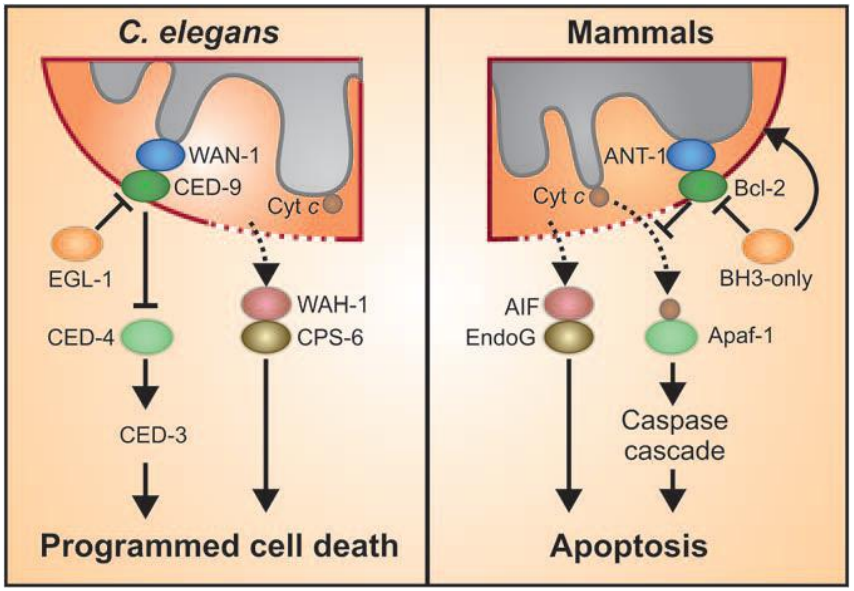
MPT: Mitochondria permeability transition

MOMP: Mitochondria outer membrane permeabilization

PTPC: Permeability transition pore complex

Armstrong 2006

ANT in programmed cell death



***C. elegans*:**

WAN-1 mutant is lethal.

Mammals:

ANT1 and ANT3 are pro-apoptotic proteins, whereas ANT2 exerts pro-survival functions.

Yeast AAC mutants protect yeast cells from cell death through regulation of the permeability of mitochondria membrane and release of Cyt c.

The role of ANT in regulation of cell death by MPT is conserved across nematodes and mammals, and ANT makes a phylogenetically old contribution to the cell death machinery in yeast.

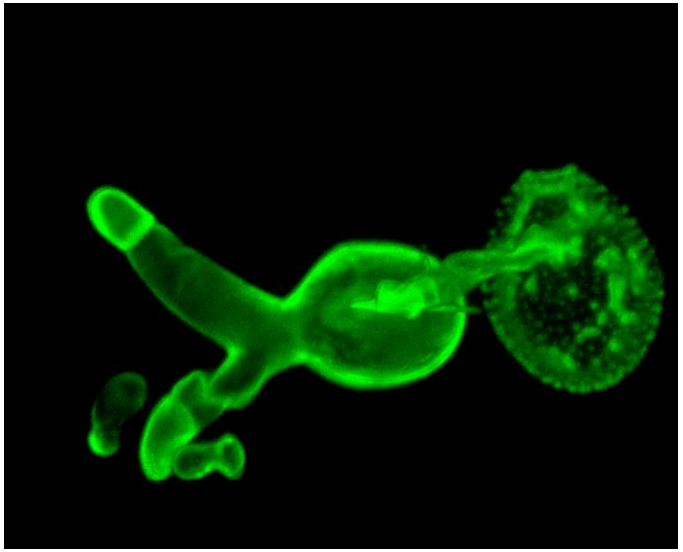
Zhivotovsky et al. 2009

Programmed cell death in pathogenic fungi

- Comparative analysis of the genome of 11 fungal species revealed more than 100 apoptosis-associated genes.
- In filamentous fungi, homologues of several apoptotic proteins have been found.
- Deletion of two genes encoding mitochondrial AIF-like oxidoreductase of *Posospora anserina*, leads to increased stress tolerance and life expansion.
- Overexpression of cyclophilin D accelerated aging and cell death in *Posospora anserina*.

Filamentous fungi may share similar components with mammals and *C. elegans* in the apoptosis pathway.

Wheat stripe rust

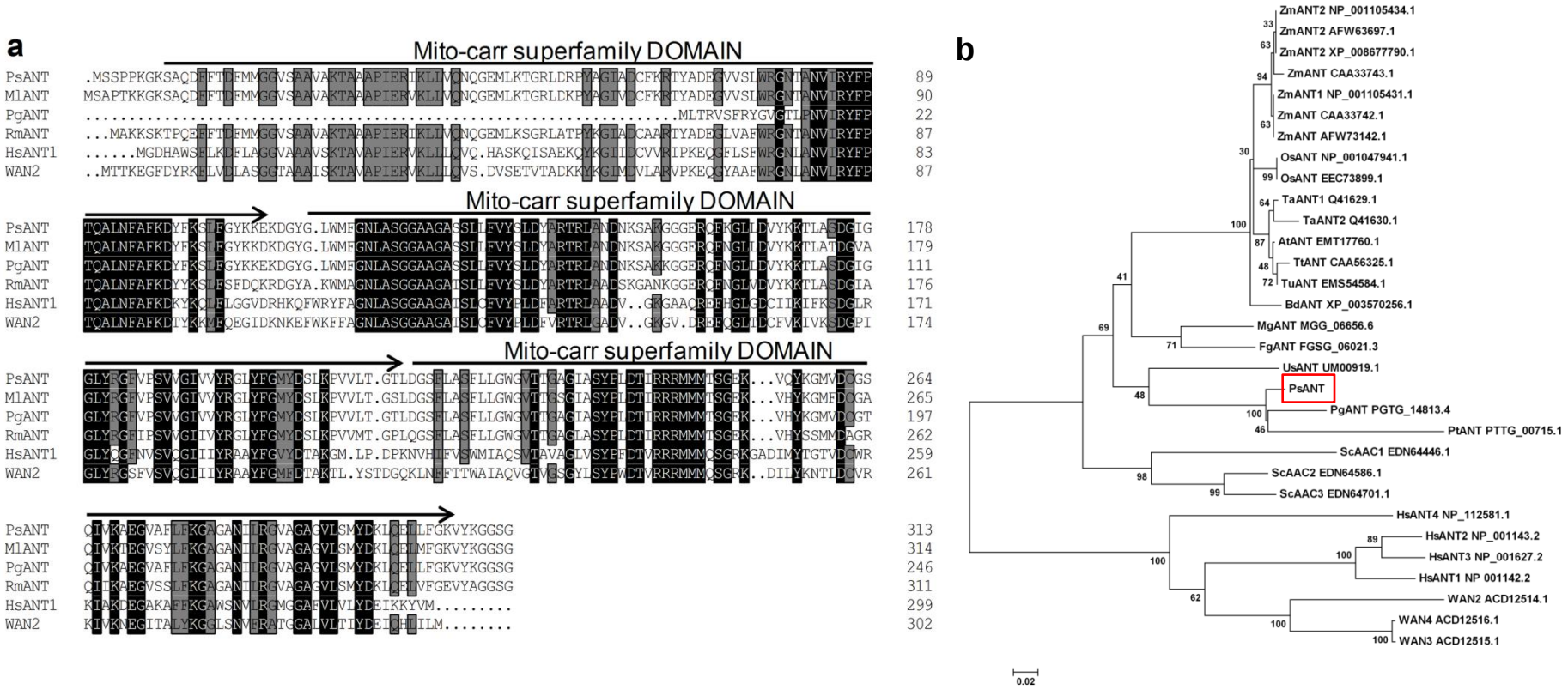


Understanding of programmed cell death (PCD) responses in pathogenic fungi may offer a chance of exploiting the fungal molecular death machinery to control fungal infections.

What about the role of ANT in PCD of *Puccinia Striiformis*?

Results

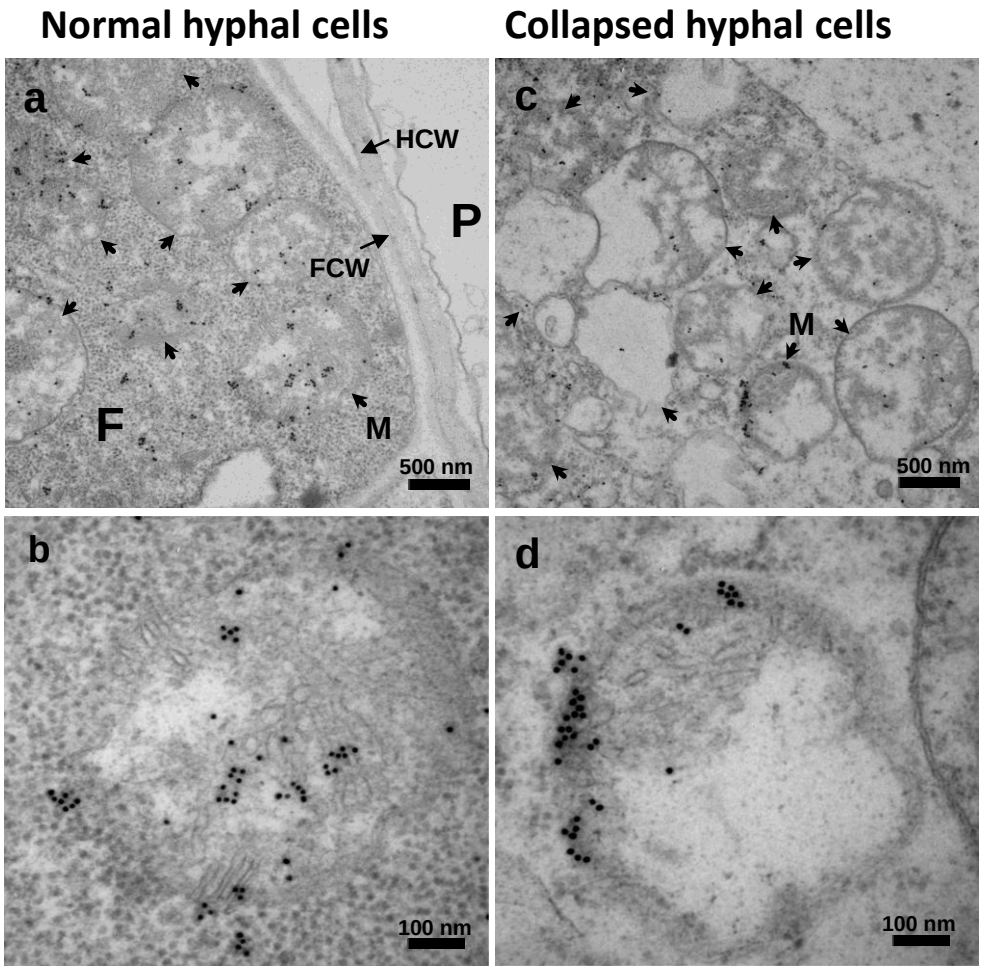
PsANT

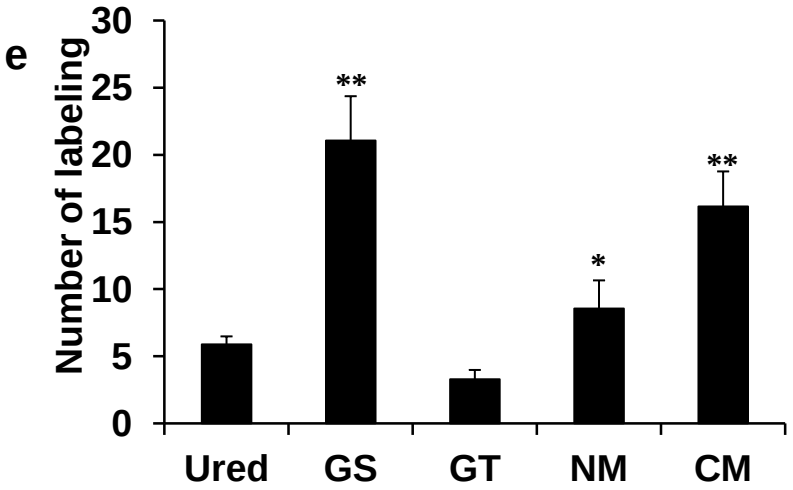


PsANT is conserved among animals, plants and fungi.

- Cell death modulation role of *PsANT*
- Contribution of *PsANT* in the development and pathogenicity of *Pst*

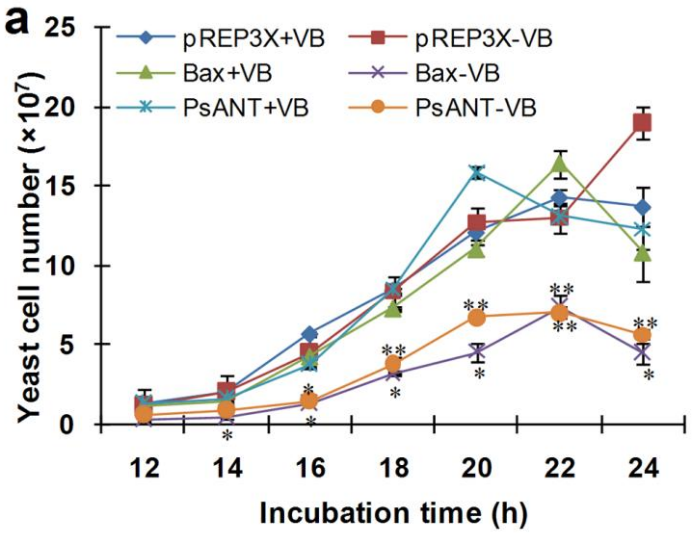
PsANT protein is localized in mitochondria of the invasion hyphae of *Pst*

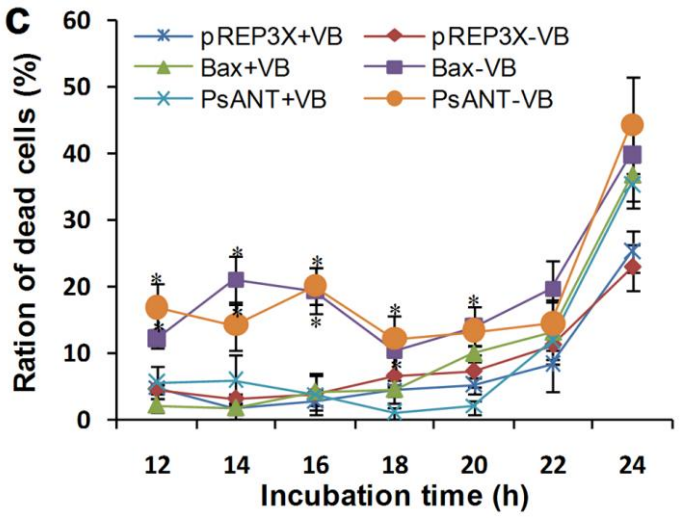


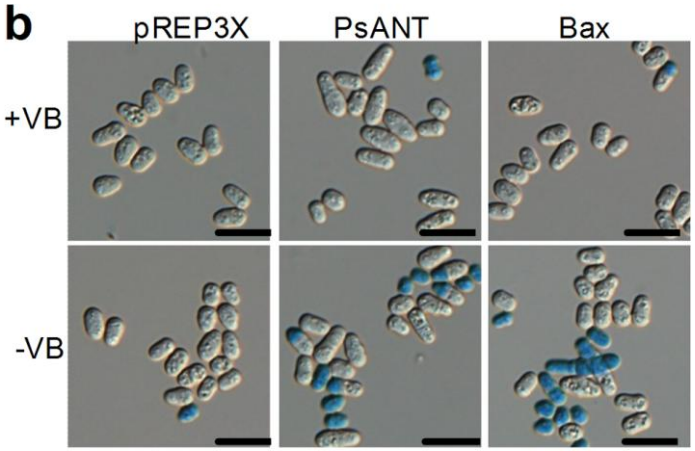


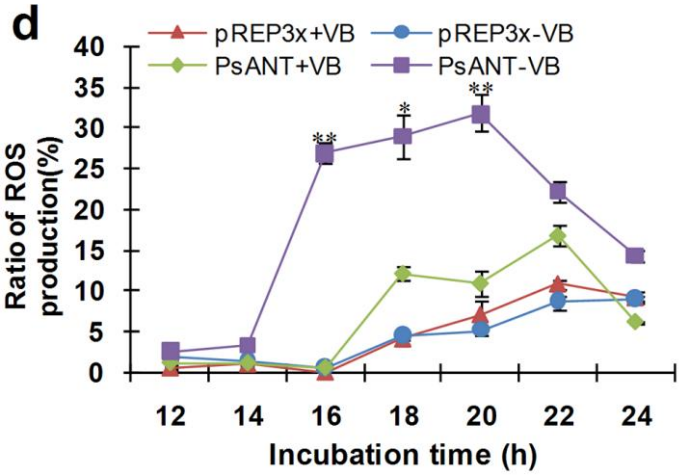
PsANT is not only involved in the energy supply for germination of uredinospores, but also in the apoptosis of *Pst*.

Over-expression of *PsANT* led to cell death in fission yeast with accumulated ROS

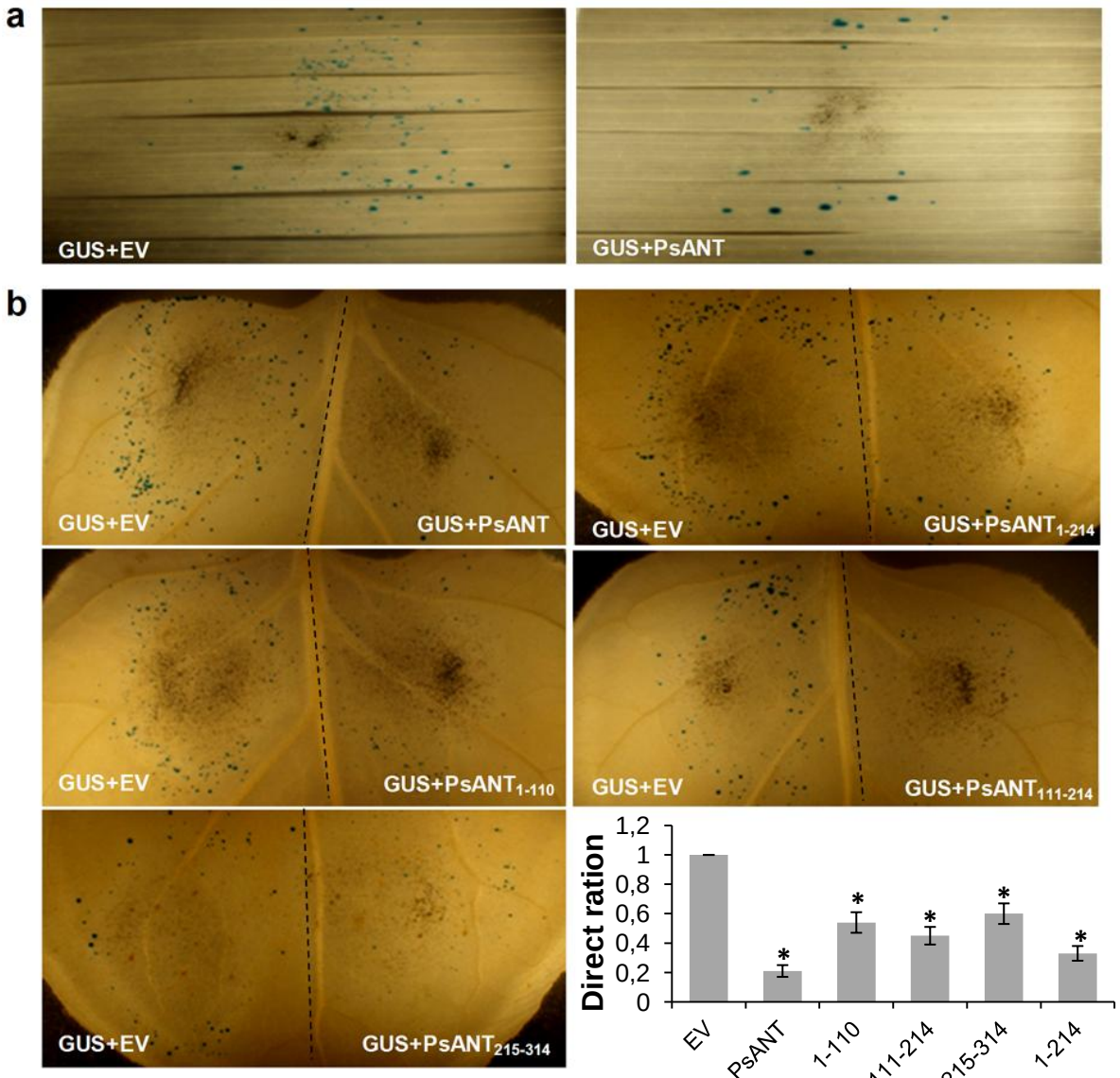




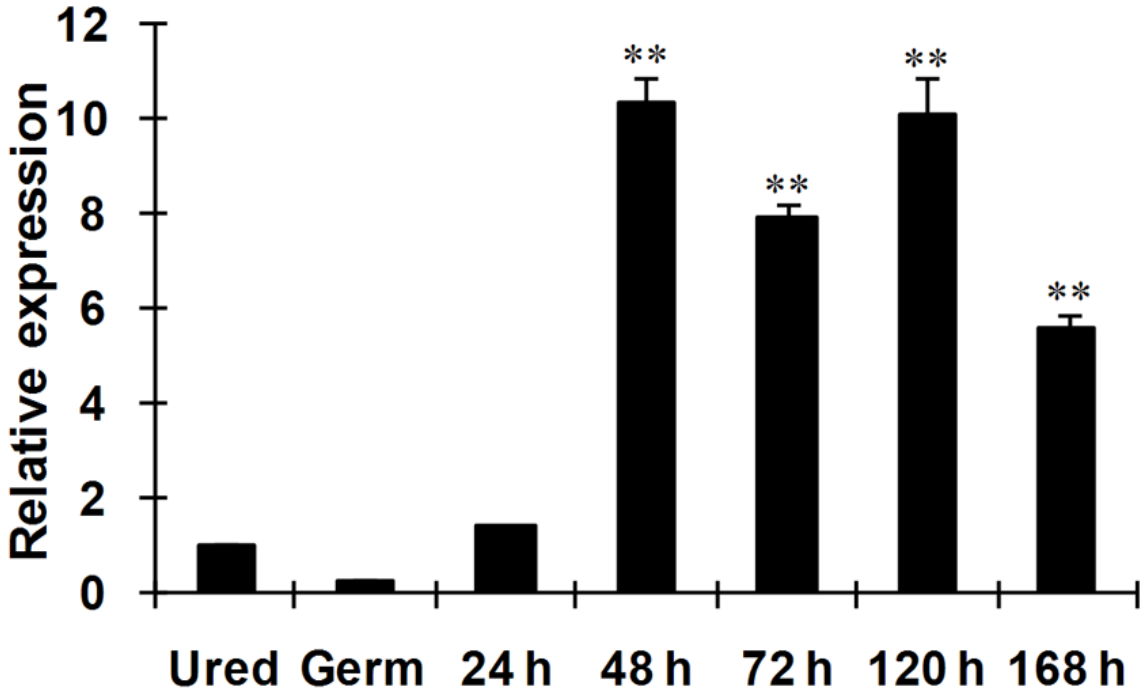




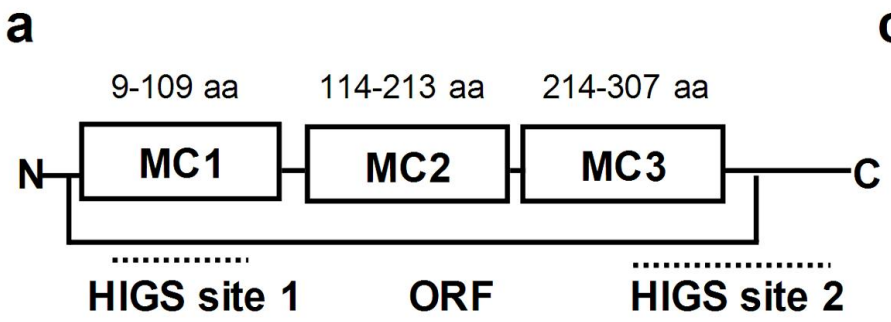
Transient-expression of *PsANT* induced cell death in wheat and tobacco cells

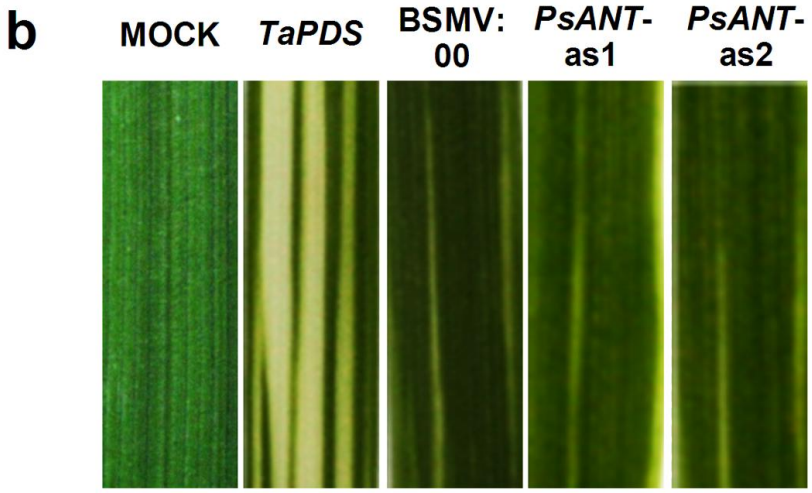


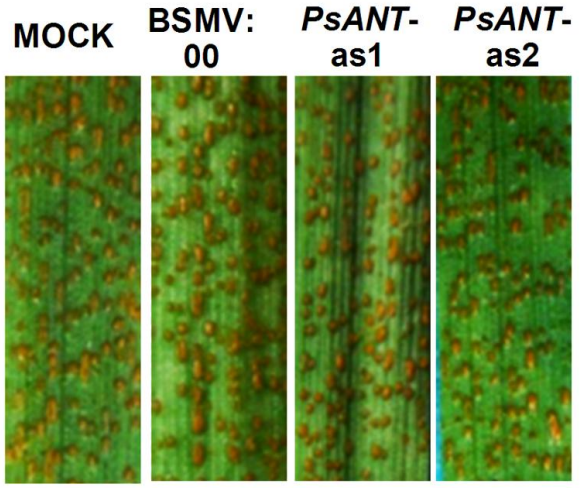
PsANT is up-regulated during infection of *Pst* in wheat

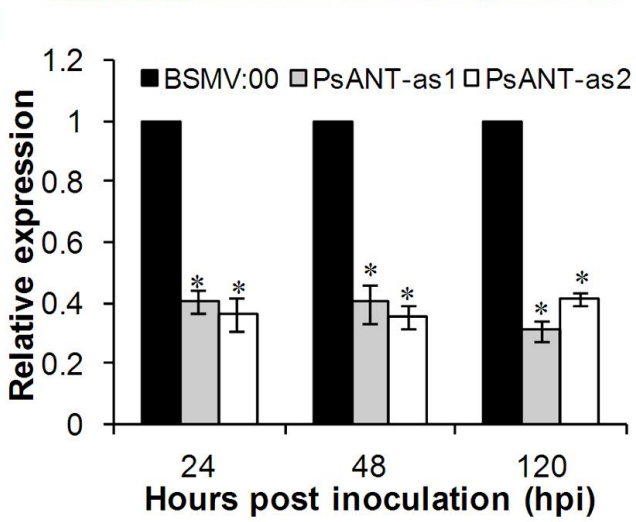


Silencing of *PsANT* did not alter the pathogenicity of *Pst*

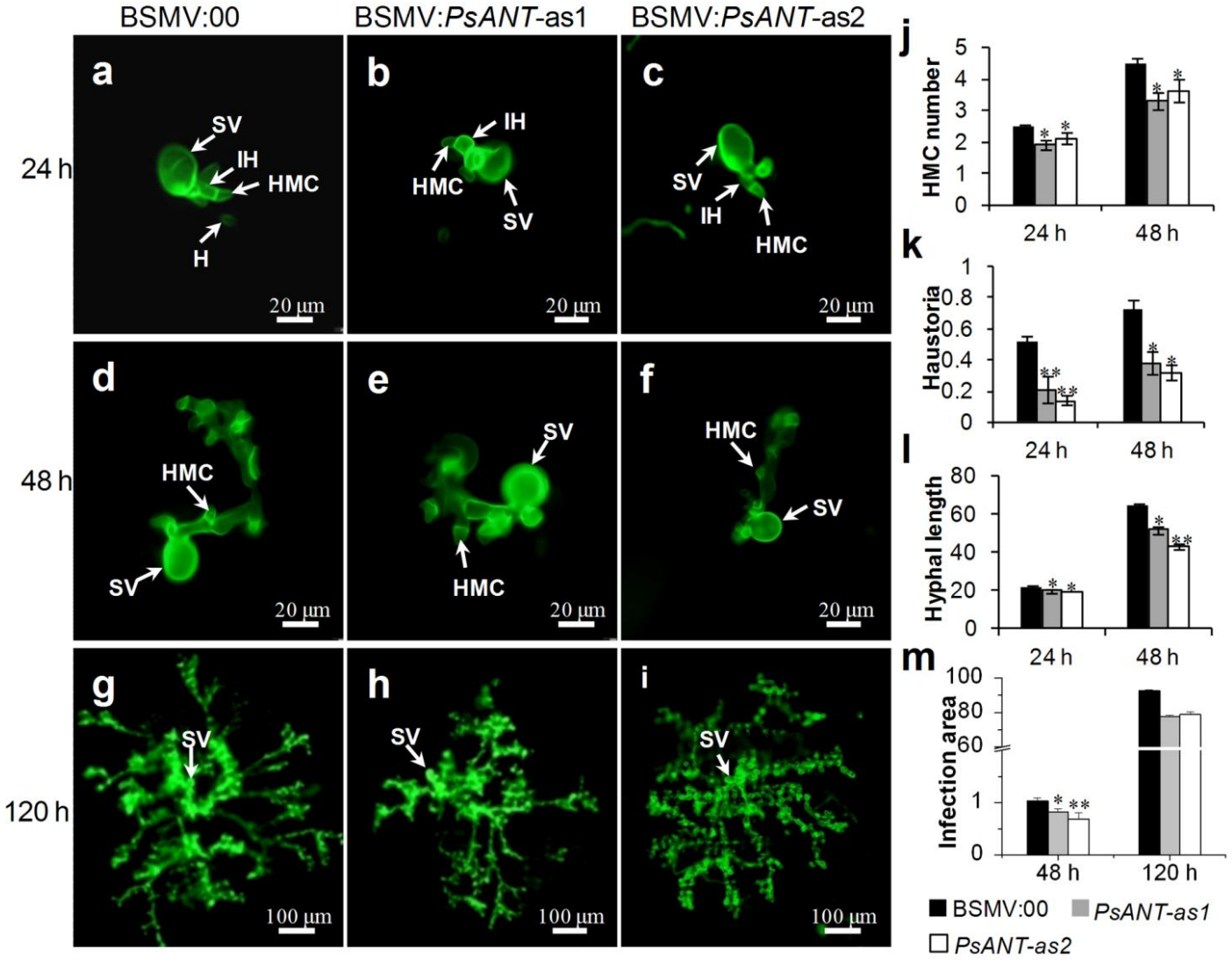








Silencing of *PsANT* attenuated *Pst* growth and development



Summary

1. ***PsANT*, encoding an adenine nucleotide translocase, is localized in mitochondria and conserved among fungi.**

2. ***PsANT* participates in fungal PCD, and the three mito-carrier domains work together to engage in cell death induction.**

3. ***PsANT* contributes to the growth and development of *Pst* at the early infection stages due to its energy supply role.**

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Thanks for your attention!