



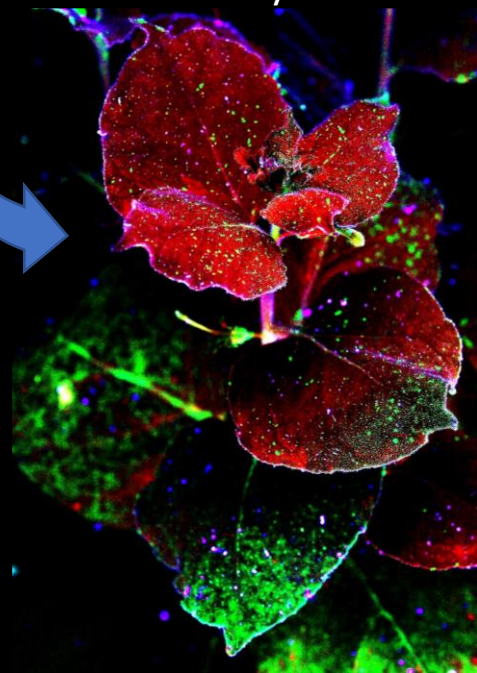
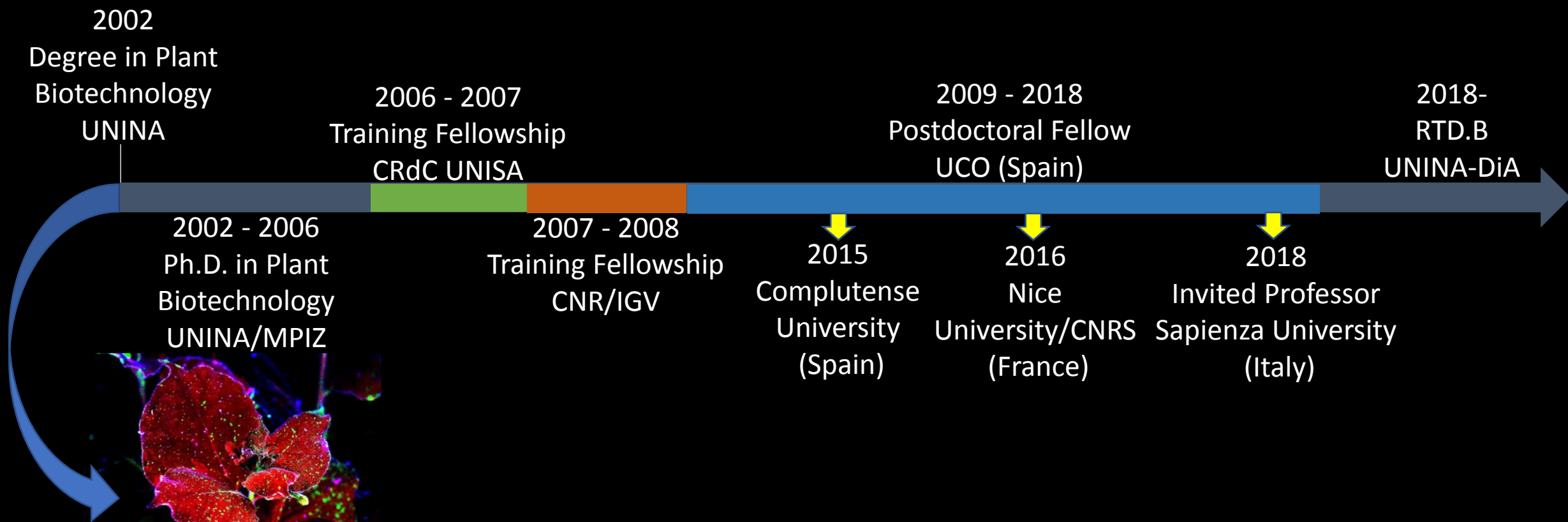
Alla ricerca dell'ospite: meccanismi usati da funghi e batteri per raggiungere le radici della pianta

DAVID TURRA'

30 Ottobre 2019
Sala Cinese

- Traiettorie scientifica
- Il sensing nei funghi
- *Fusarium oxysporum* come sistema modello
- Alcuni esempi

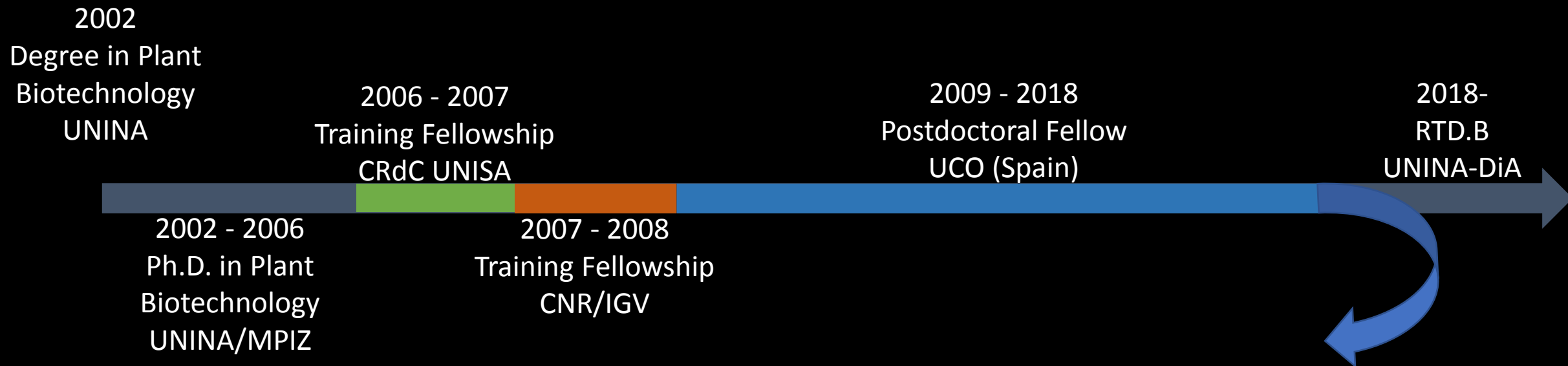
Traiettoria scientifica



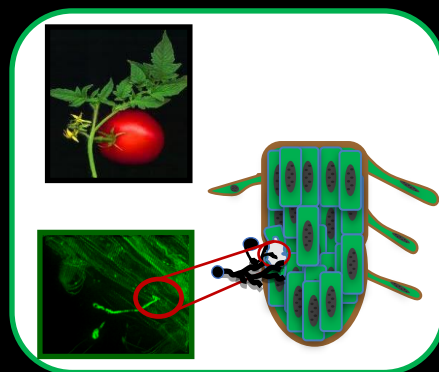
Caratterizzazione ed espressione di proteine di origine vegetale con attività antimicrobica

Turrà D. 2006. *J. Plant Pathol.* / Hermosa R. et al. 2006. *Physiol. Mol. Plant Pathol.* / Turrà D. et al. 2009. *J. Plant Physiol.* / Turrà D and Lorito M. 2011. *Curr. Protein Pept. Sci.* / Turrà et al. 2019. *Front Plant Sci* (submitted).

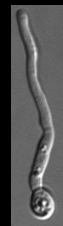
Traiettoria scientifica



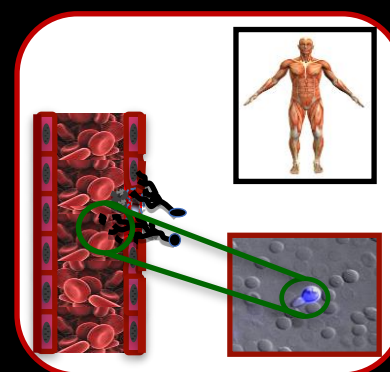
Basi molecolari dell'interazione tra funghi patogeni ed i loro ospiti



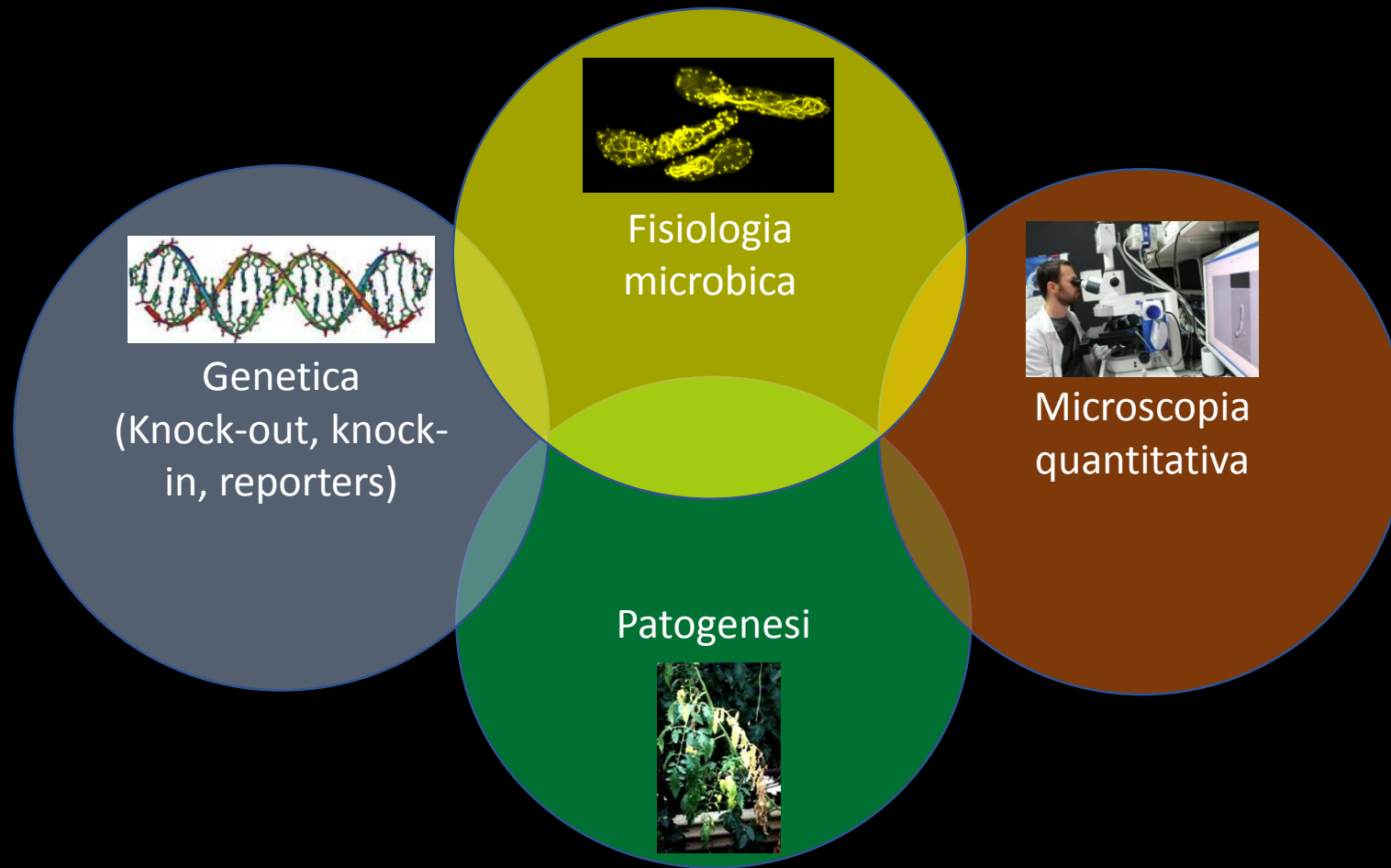
?



?



La ricerca



Cos'è il sensing e a cosa serve?

Le cellule eucariotiche sono continuamente soggette a molteplici stimoli esterni
la cui intensità varia nello spazio e nel tempo

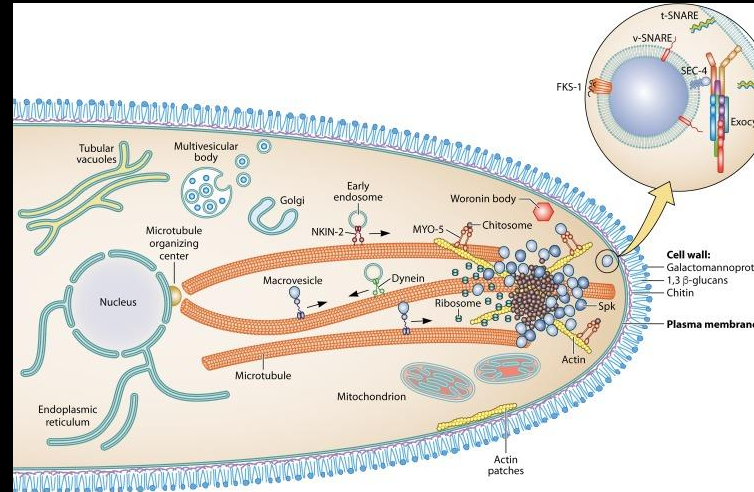


Manning et al. 2002 *Trends Biochem Sci*

- Stimoli fisici
- Stimoli chimici
- Combinazioni di entrambe

Cos'è il sensing e a cosa serve

- Stimoli fisici
- Stimoli chimici
- Combinazioni di entrambe



Riquelme et al. 2018 Microbiol Mol Biol Rev

Ridirezionamento

Attrazione

Repulsione

Chemotropismo

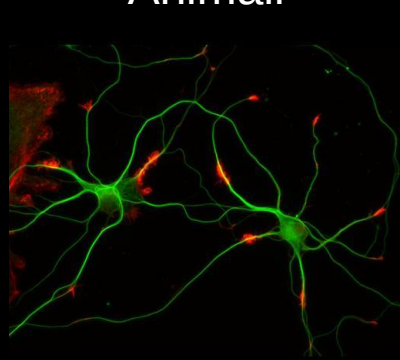
Crescita direzionale in risposta ad uno stimolo chimico

Piante



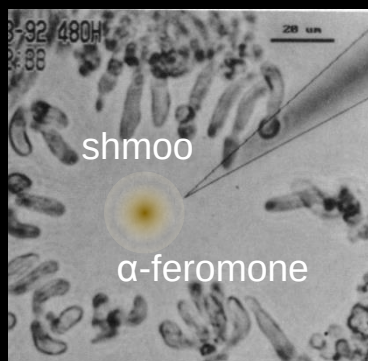
Kim *et al.* (2003) *PNAS*

Animali

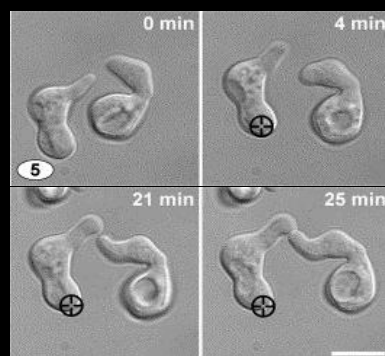


Brandner and Withers 2010 *CIL*:10233

Funghi

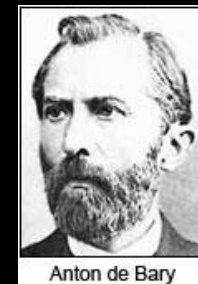
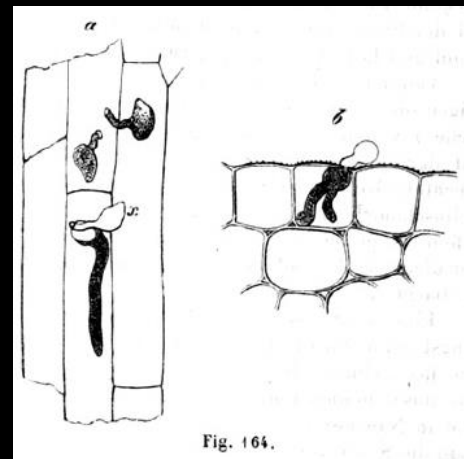


Segall (1993) *PNAS*



Roca *et al.* (2005) *Eukaryot Cell*

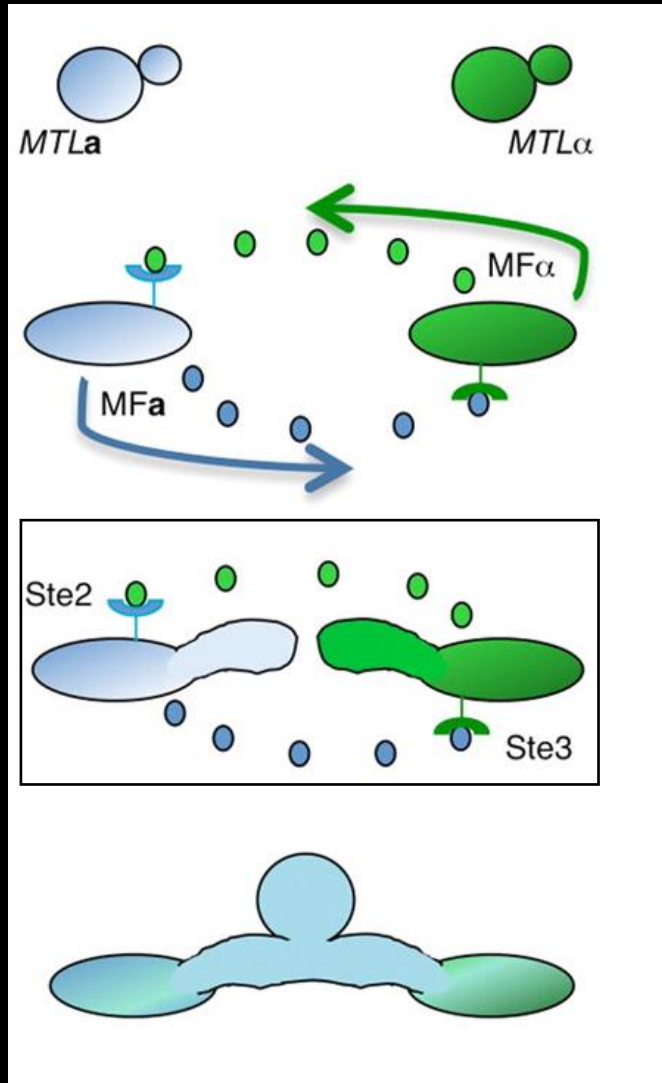
1° osservazione sul chemotropismo



1. Perché un tubo germinativo gira la sua estremità verso la membrana dell'ospite, ma non verso qualsiasi membrana o superficie umida?
2. Esistono specifici stimoli chimici o fisici prodotti dalla superficie dell'ospite che inducono reazioni specifiche nel parassita?

“Queste domande rappresentano un argomento di grande interesse per la ricerca scientifica”

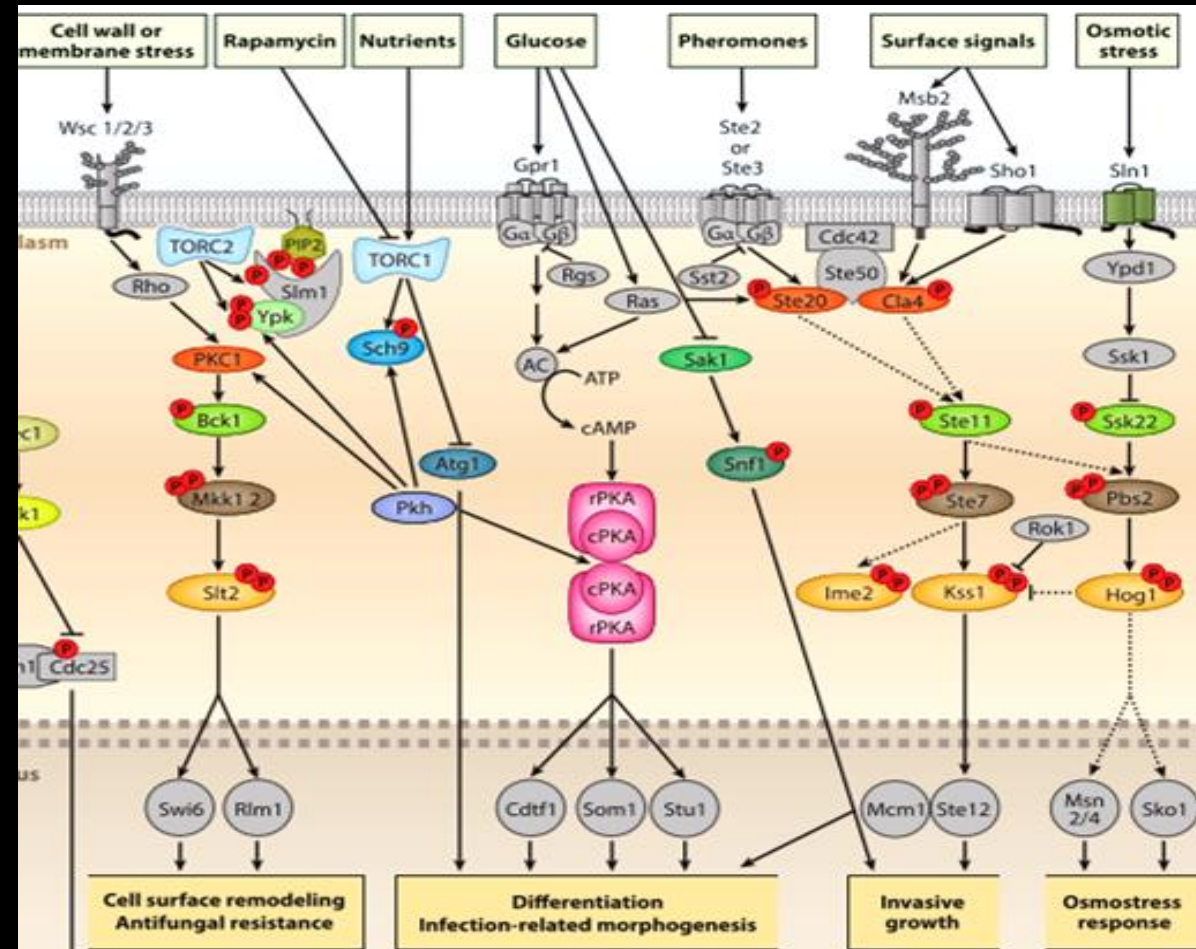
Segnali e meccanismi di segnalazione noti nei funghi



Shmoo formation

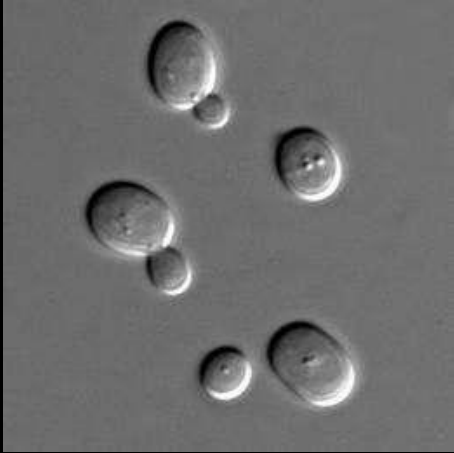
Polarized growth

Adapted from: Bennett and Dunny (2010) mBio.



Perché *Fusarium oxysporum*?

Lieviti (*S. cerevisiae*)



Normalmente
budding



Mating
shmoo

Funghi filamentosi (*F. oxysporum*)



Turrà. *Unpublished*

Perché *Fusarium oxysporum*?

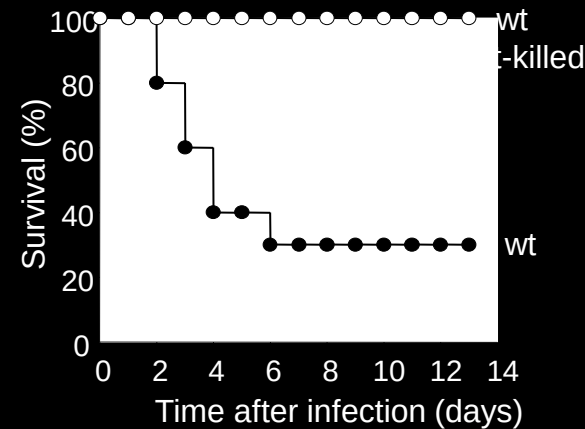
F. oxysporum f. sp. *lycopersici* 4287
(sequenced reference strain)



Tomato plants

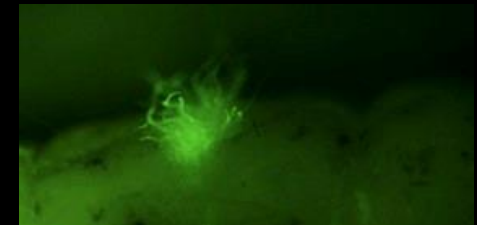
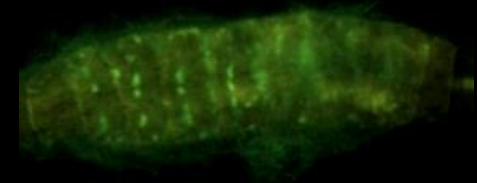


Immunodepressed mice



Ortoneda et al. 2004, *Infect Immun*

Galleria mellonella larvae

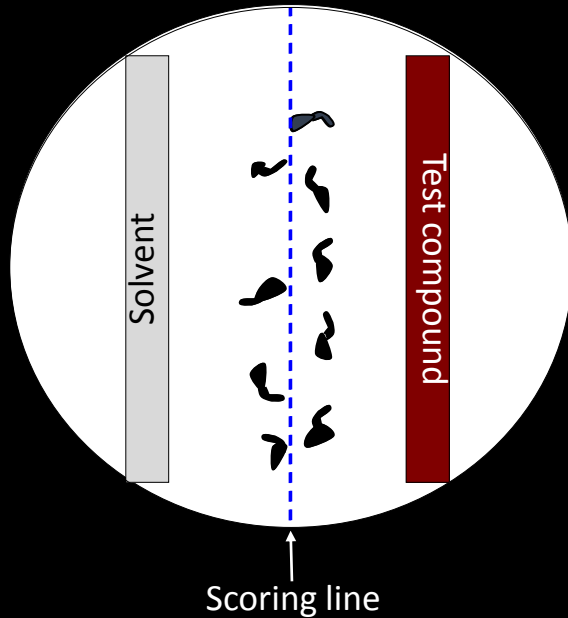


Navarro-Velasco et al. 2011, *FGB*

Un nuovo saggio per studiare il chemotropismo



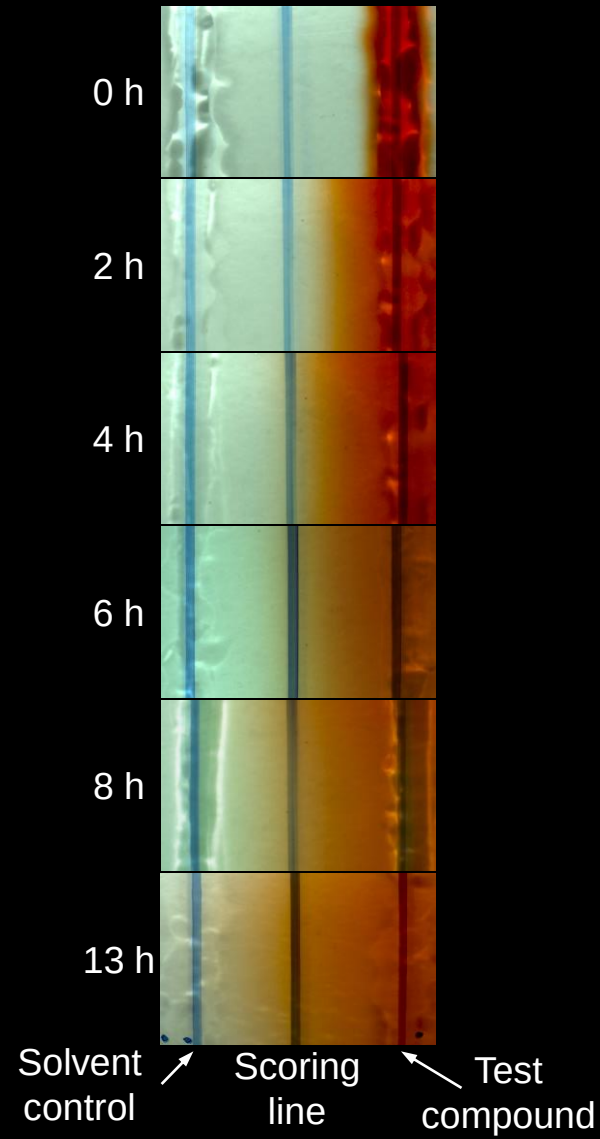
Un nuovo saggio per studiare il chemotropismo



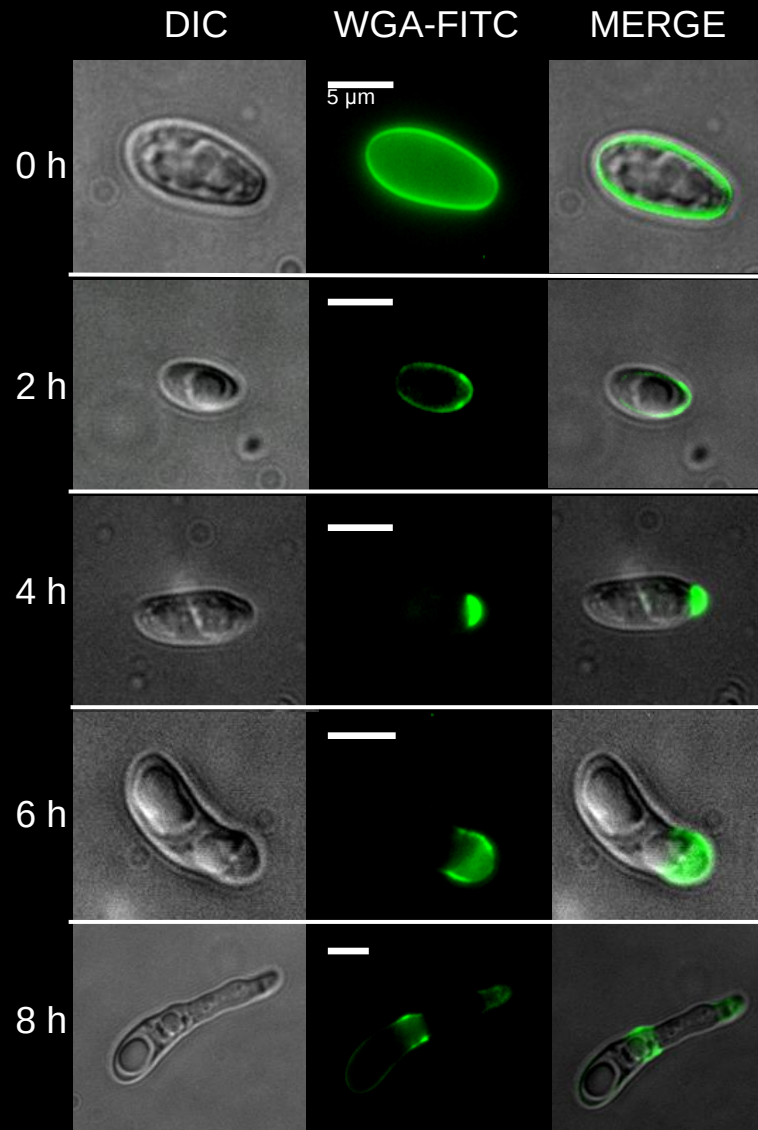
Chemotropic Index:

$$\frac{n^{\circ} H_{\text{test}} - n^{\circ} H_{\text{solv}}}{n^{\circ} H_{\text{total}}} \times 100$$

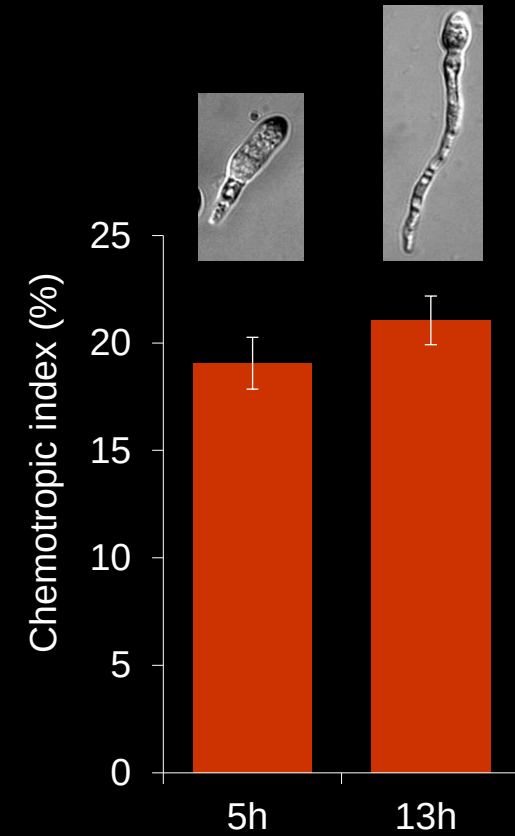
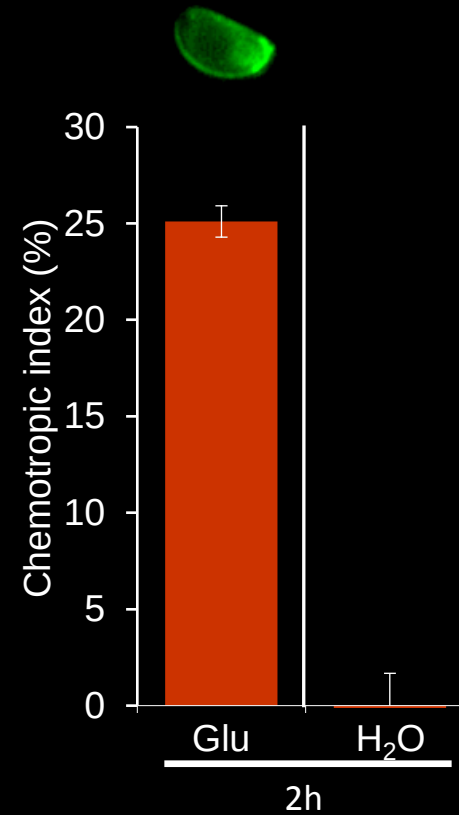
Diffusion and gradient establishment



Proof of concept



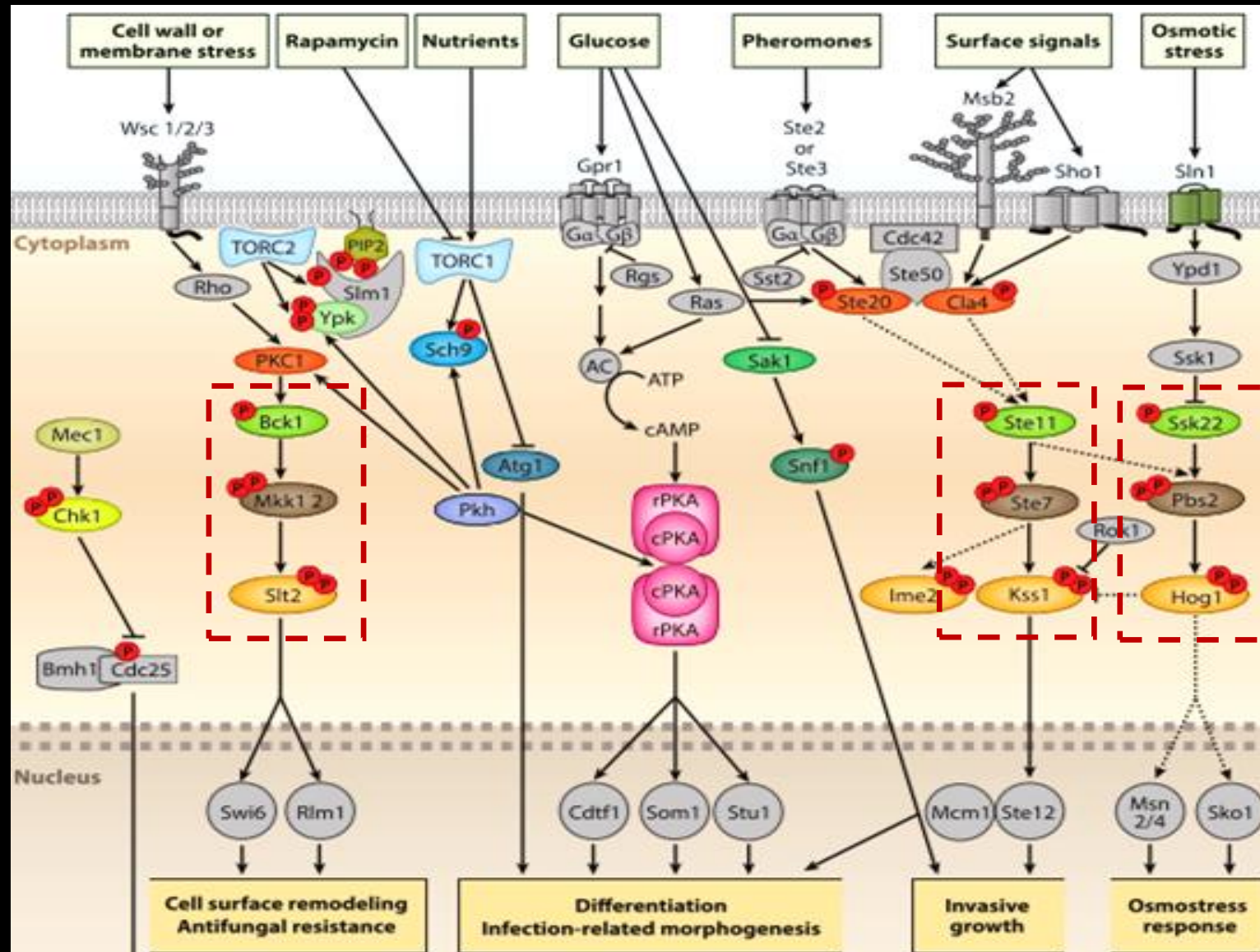
Turrà *et al.* (2015) Nature



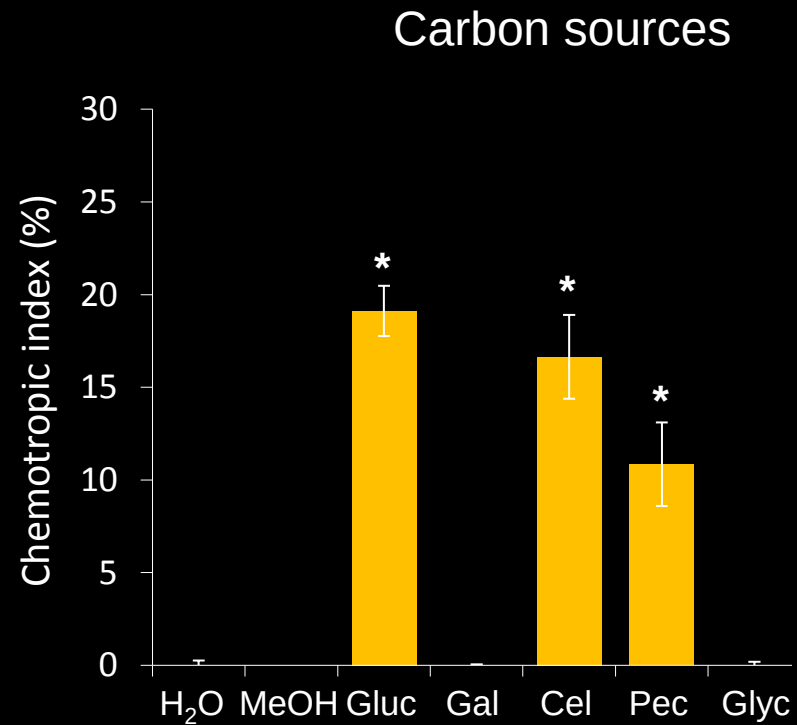
Come possiamo usare questo saggio?

1. Identificazione di vie di segnalizzazione
2. Identificazione di segnali endogeni
3. Identificazione di segnali dell'ospite

Identificazione di via di segnalazione

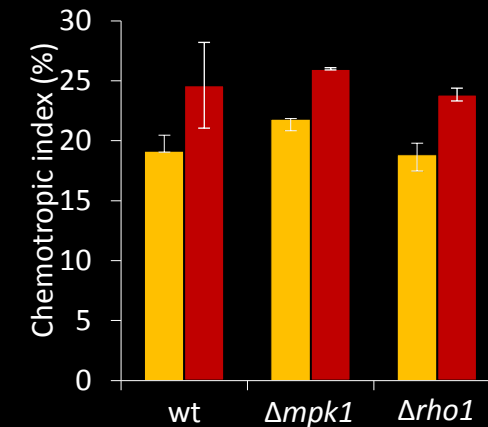
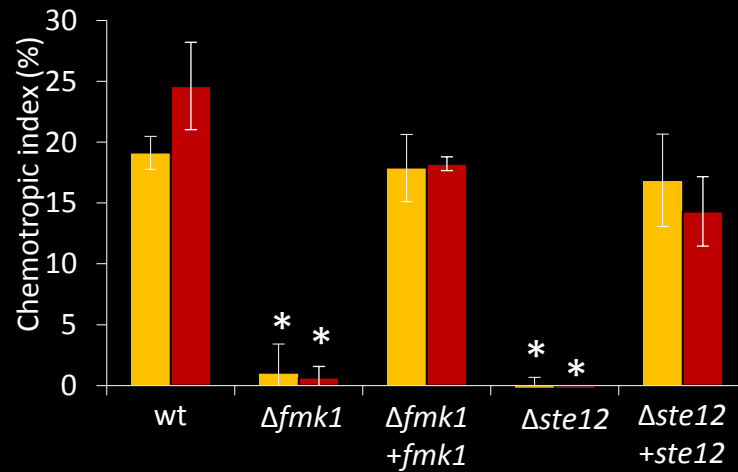
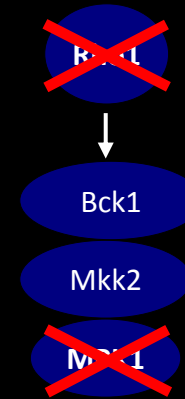
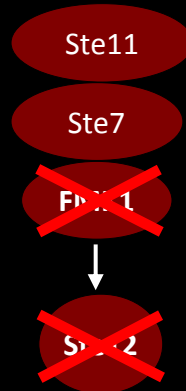


Identificazione di vie di segnalazione



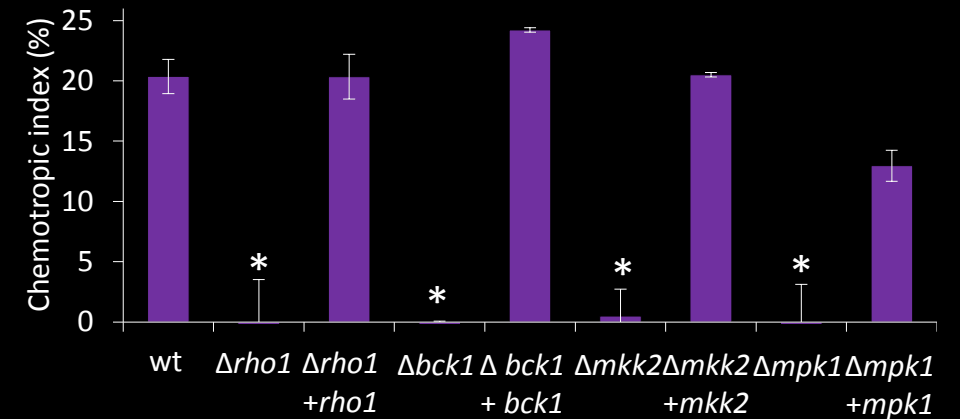
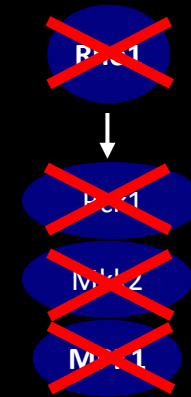
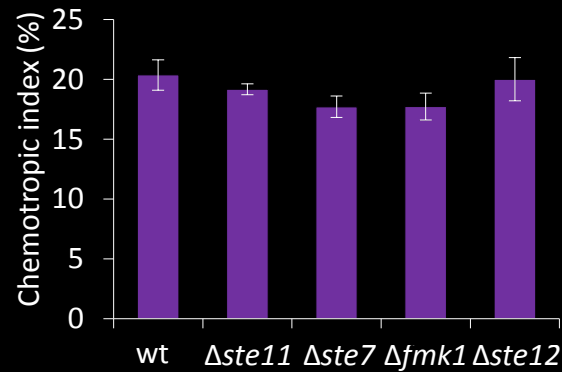
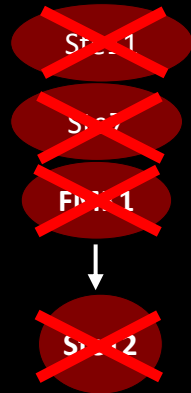
Identificazione di via di segnalazione

Glucose ●
Glutammate ●



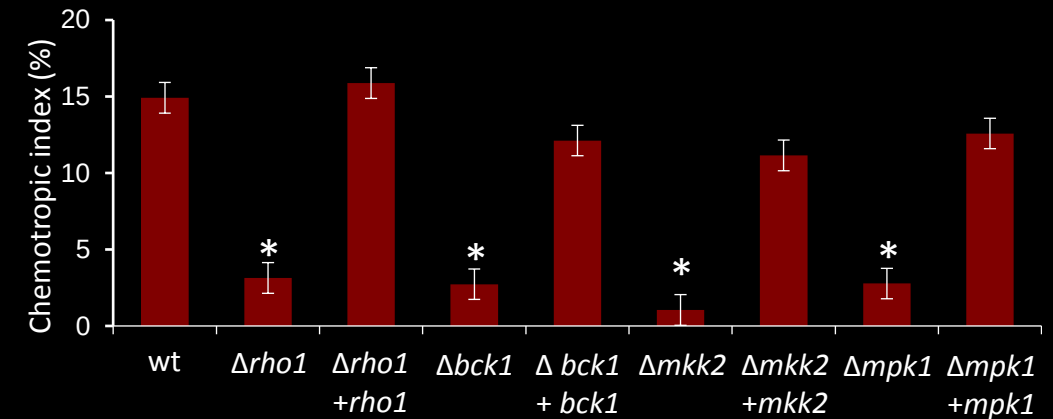
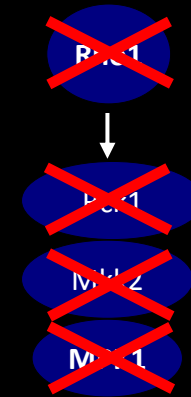
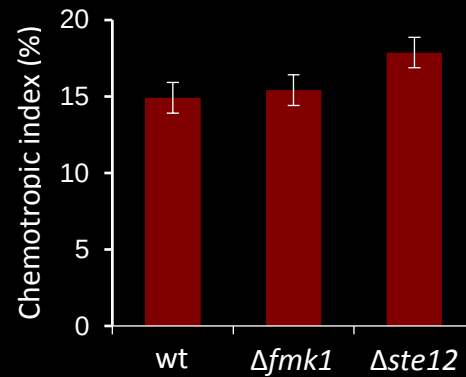
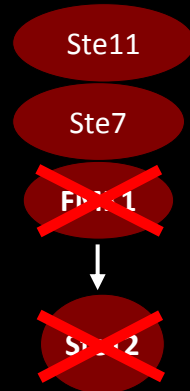
Identificazione di via di segnalazione

α -pheromone 

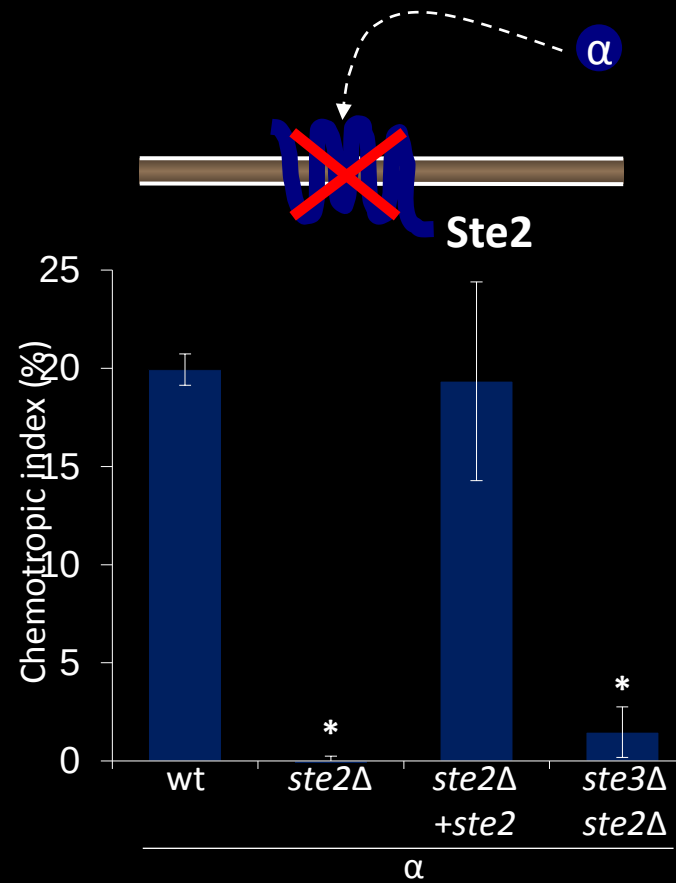


Identificazione di via di segnalazione

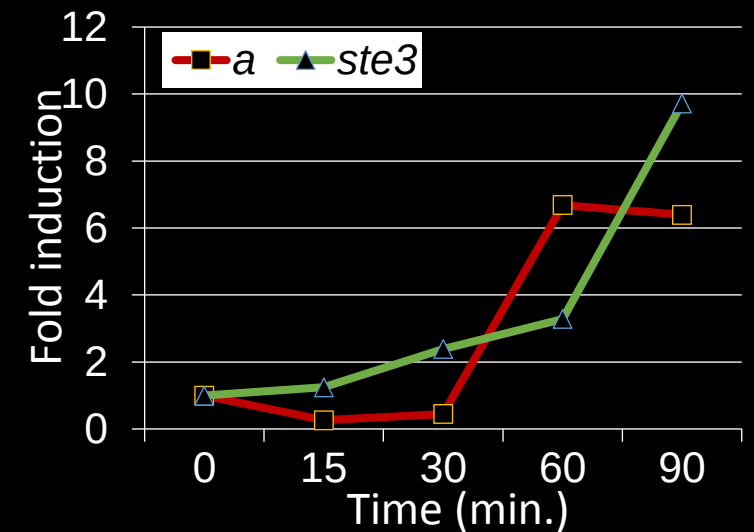
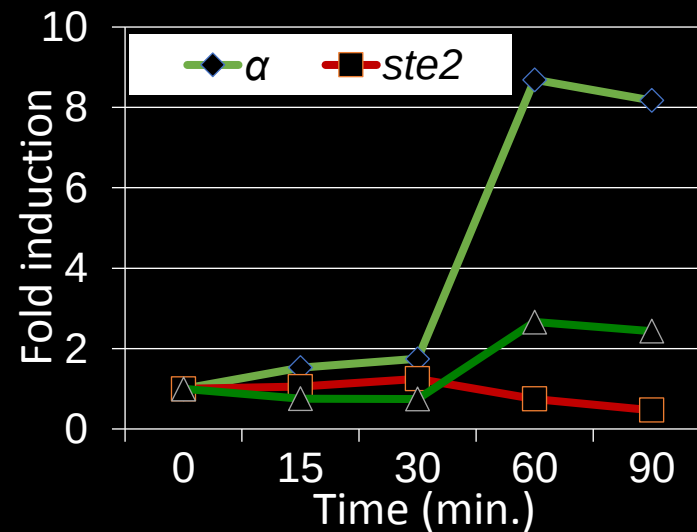
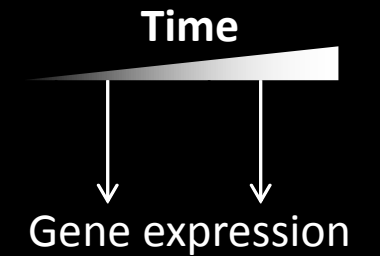
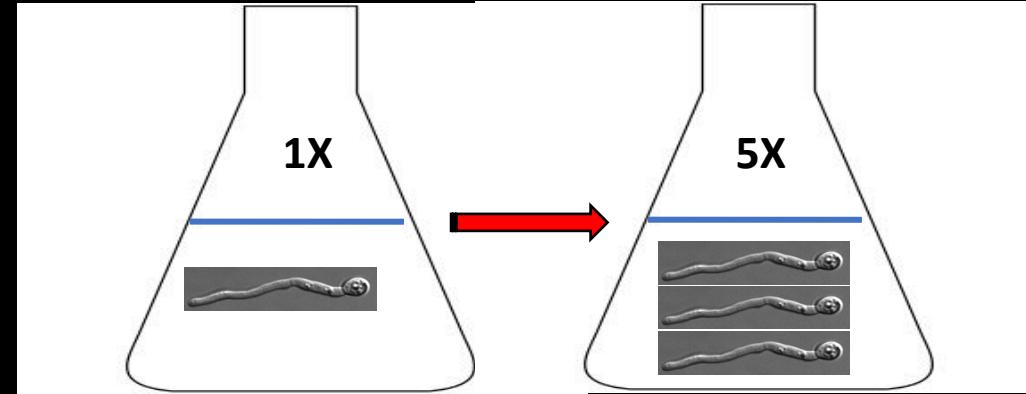
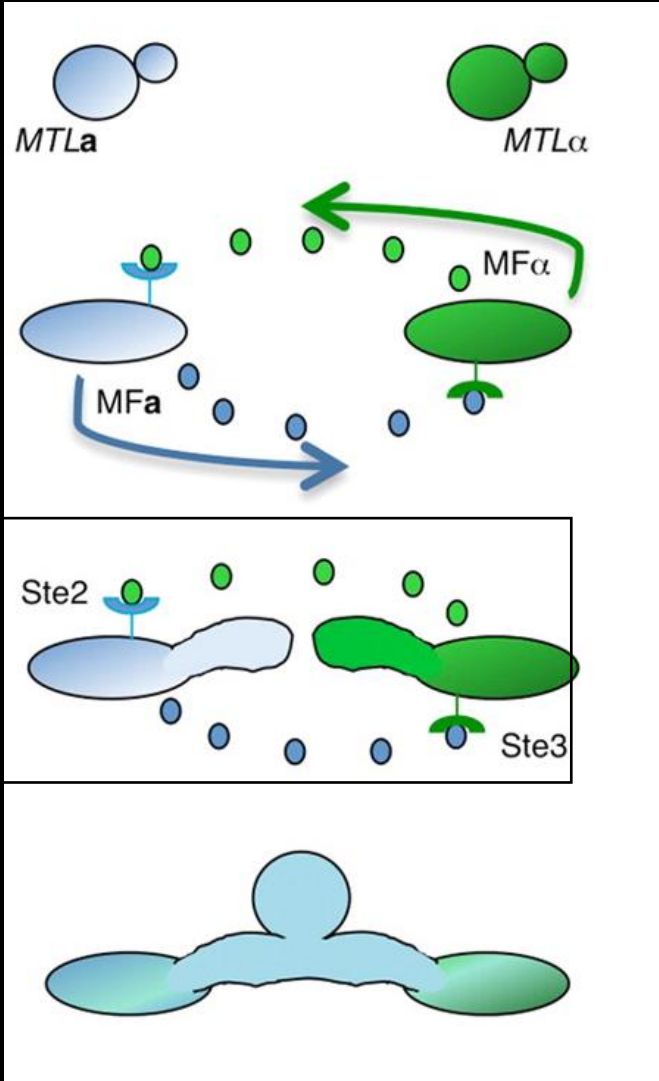
α -pheromone 



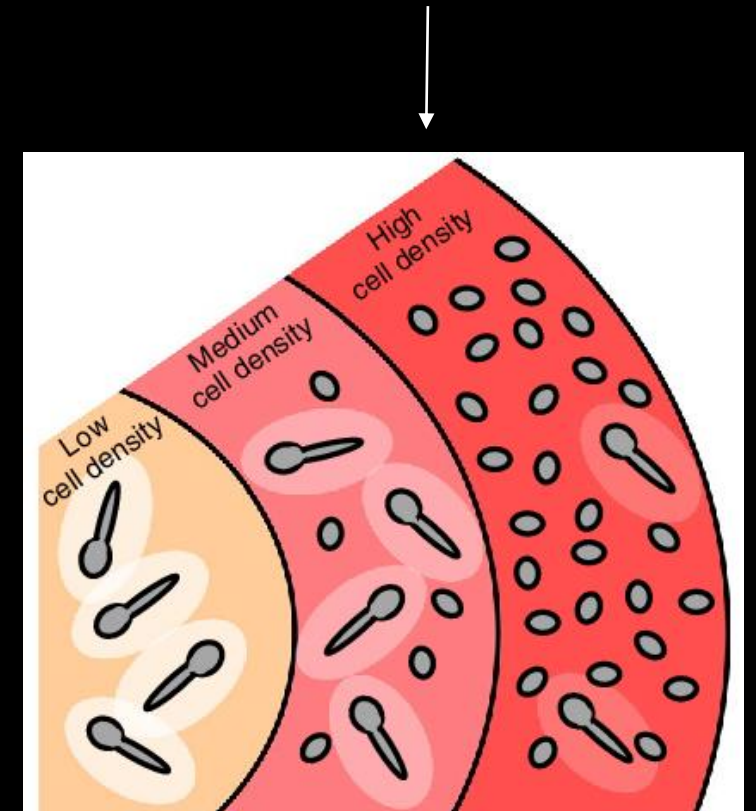
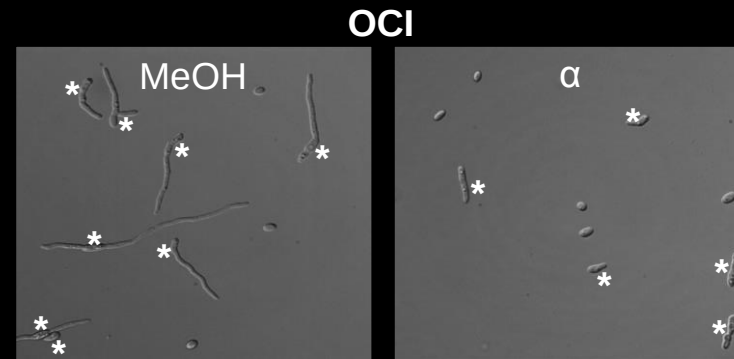
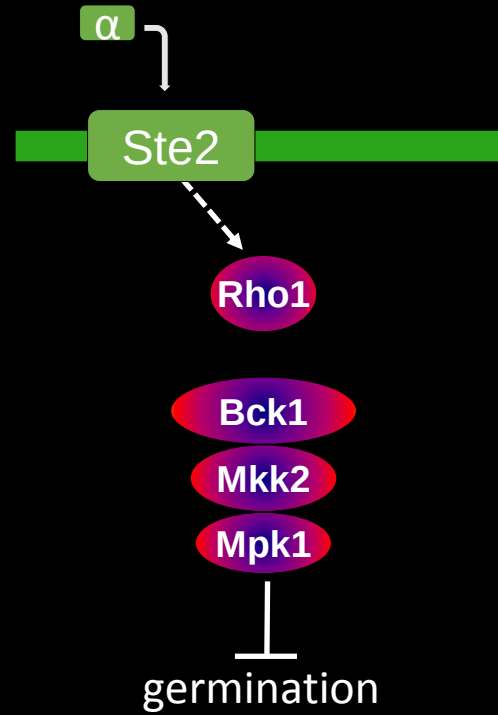
Identificazione di via di segnalazione



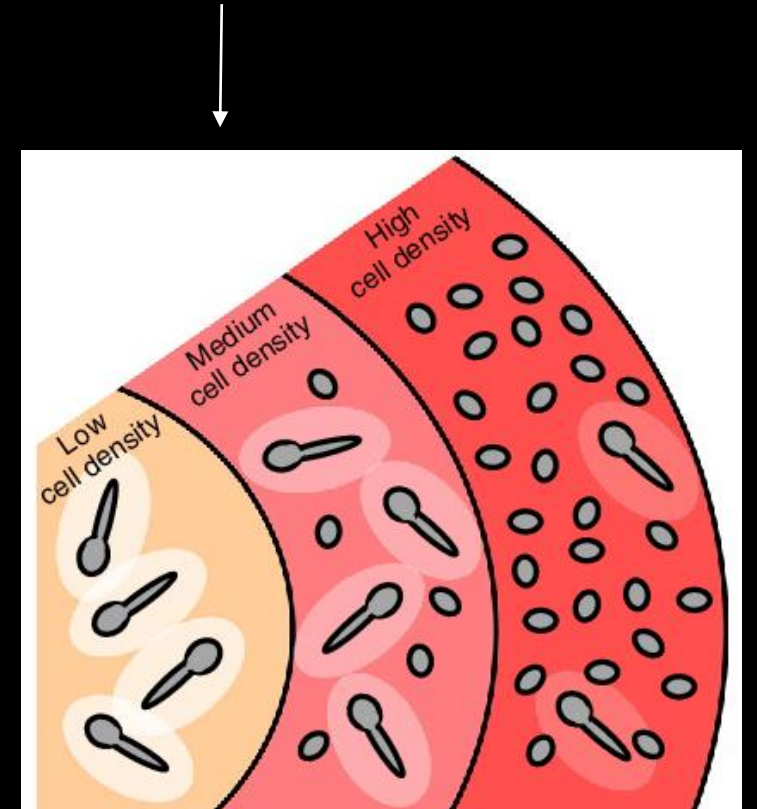
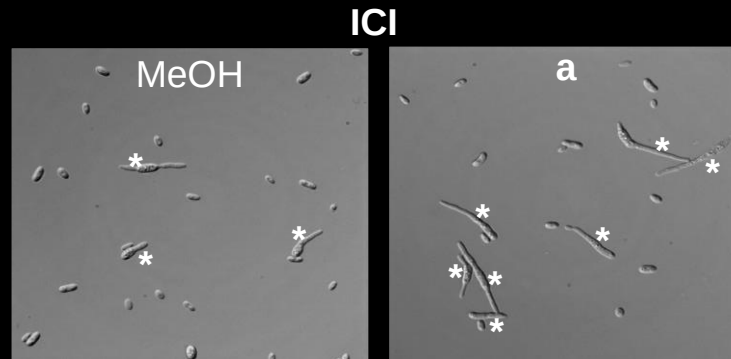
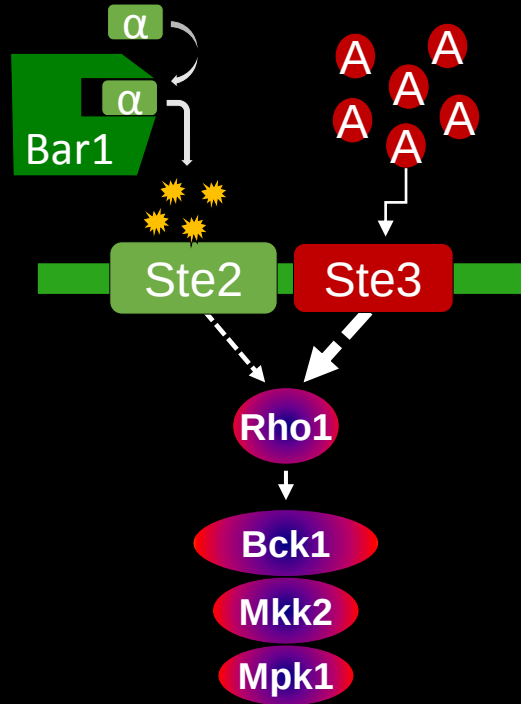
Segnali endogeni



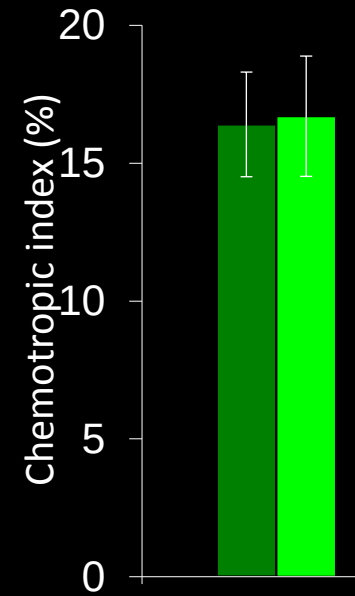
Segnali endogeni



Segnali endogeni



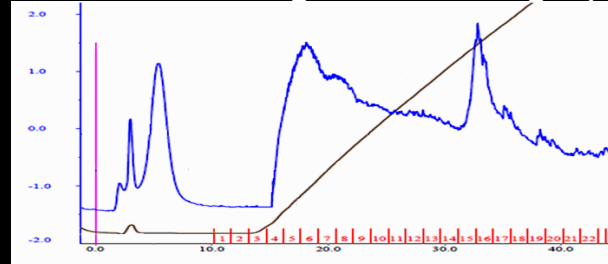
Segnali dell'ospite



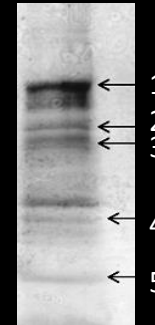
Segnali dell'ospite



Anion exchange chromatography

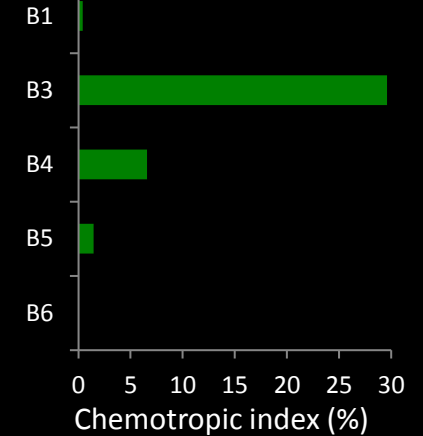


PAGE



LC-ESI-MS/MS

Chemotropism assay



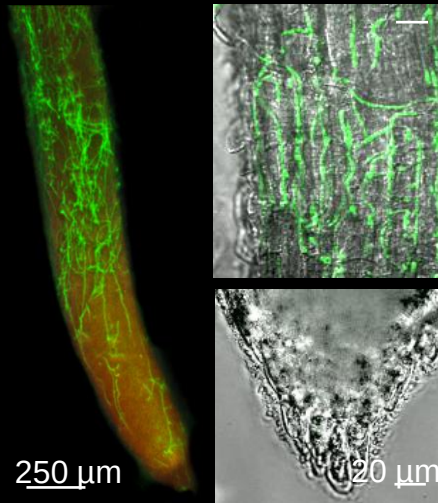
Class III peroxidases !!!



Peroxidase activity staining (ABTS)



F. oxysporum (GFP)

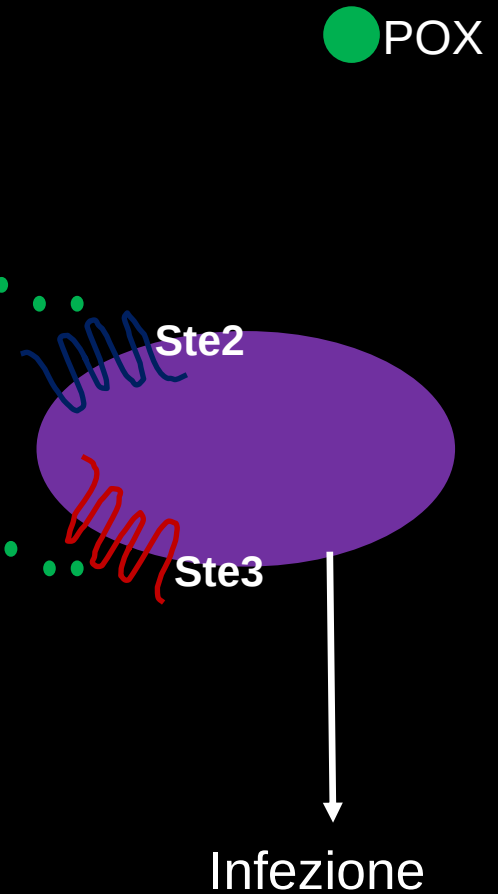
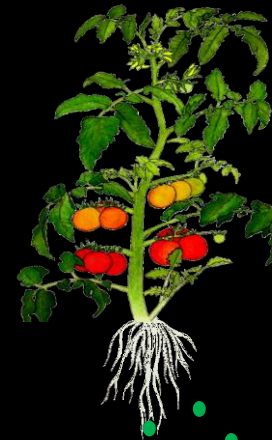
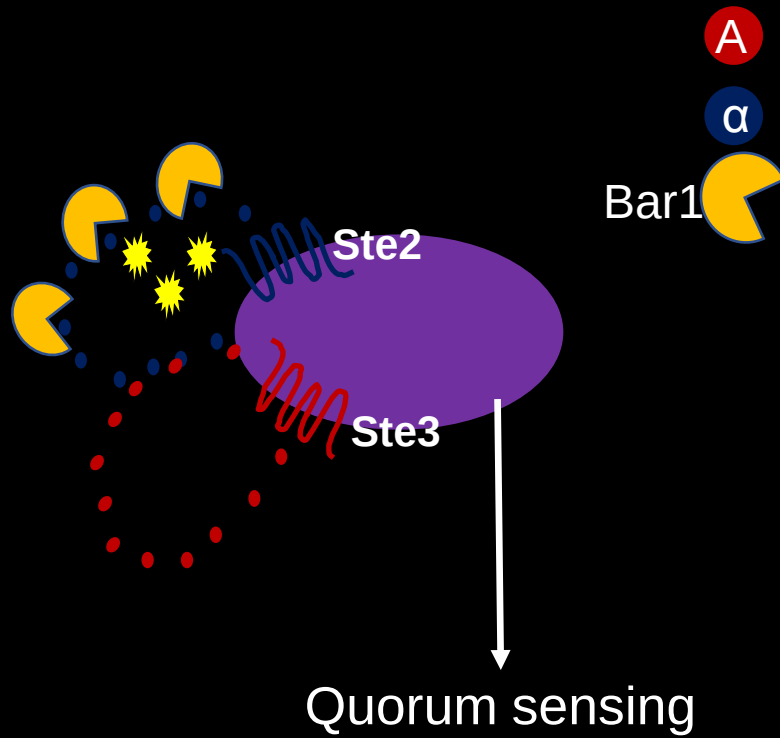


Interessi futuri

Self-sensing

VS.

Plant-sensing



Ringraziamenti

COLLABORATIONS

Universidad de Cordoba (UCO)

Rafael Palos

Carlota Alvarez

Riccardo Cantelli

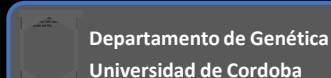
Federico Rossi

Mennat El Ghalid

Daniela Dirshnabel

Stefania Vitale

Antonio Di Pietro



Università la Sapienza (Roma, Italy)

Marzia Beccacioli

Valeria Scala

Massimo Reverberi

Università di Campobasso (Campobasso, Italy)

Davide Palmieri

Giuseppe Lima

IPF (Valencia, Spain)

Ana Conesa

Sonia Tarazona

UMass Amherst (U.S.A.)

Li-Jun Ma

Univ. Complutense (Madrid, Espana)

Marta Bruix

Alvaro del Pozo

University of Wuerzburg (Wuerzburg, Germany)

Ulrich Terpitz

University of Nice (Nice, France)

Robert Arkowitz

Martine Bassilana



Prossimo incontro: 13/11/2019

ROBERTA MARRA

Come i microrganismi (in agricoltura) salveranno e sfameranno il mondo