



ECFG15
ROME • ITALY 2020



Department of
Genetics

The MAK-1 and MAK-2 MAP kinase
modules have related but different
functions in **cell-cell fusion** in
Neurospora crassa

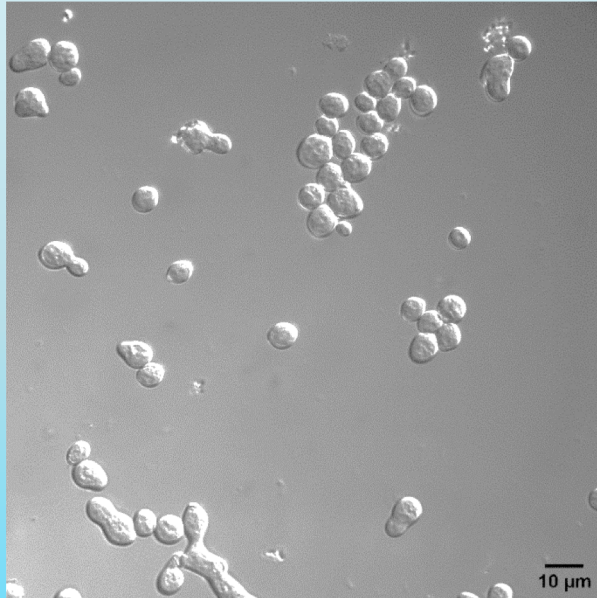
Lucas Well

The Ascomycete *Neurospora crassa*

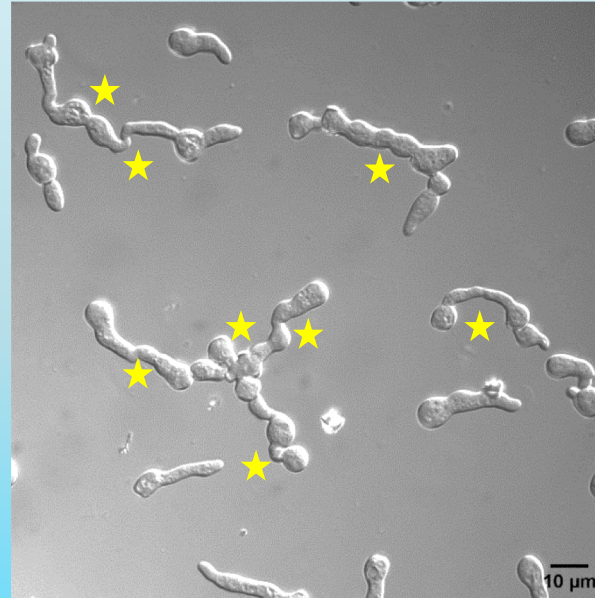


Germlings of *Neurospora crassa* fuse into a supracellular network

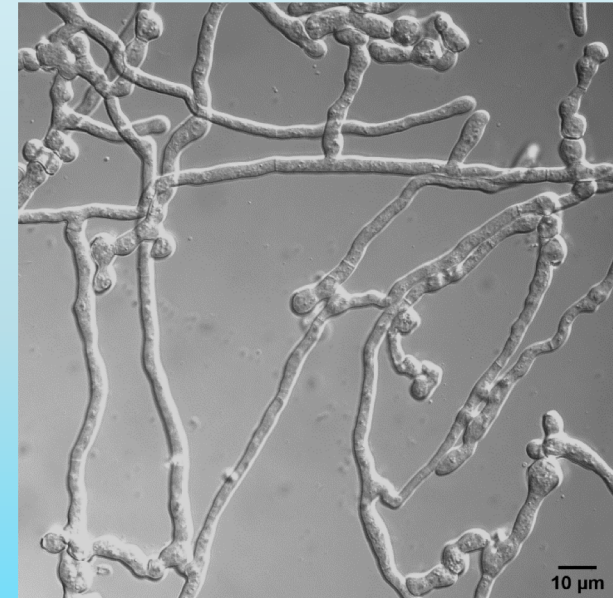
Ungerminated conidia



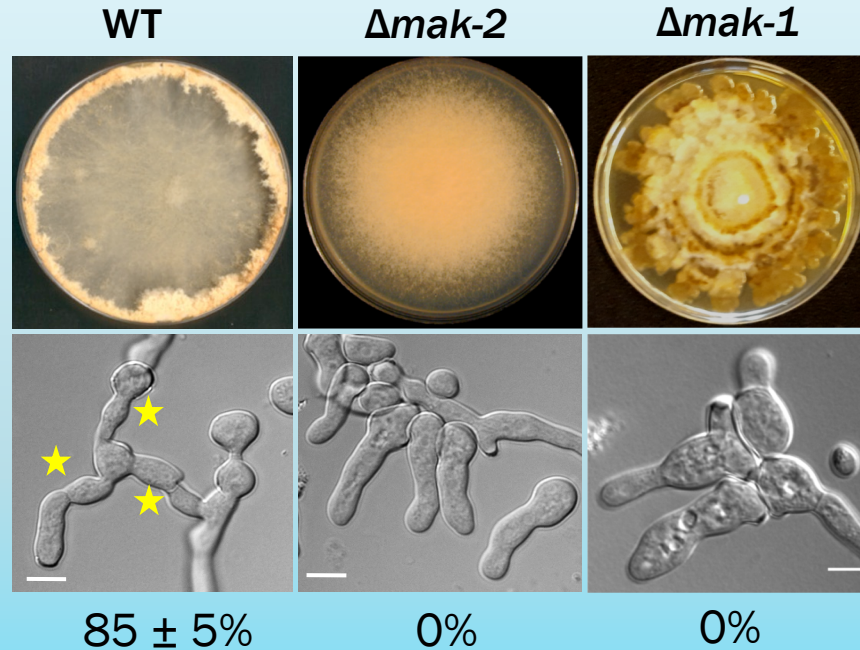
Conidia germinate, interact, and fuse



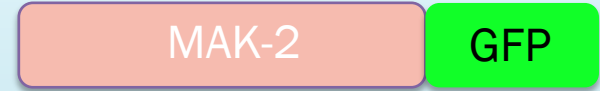
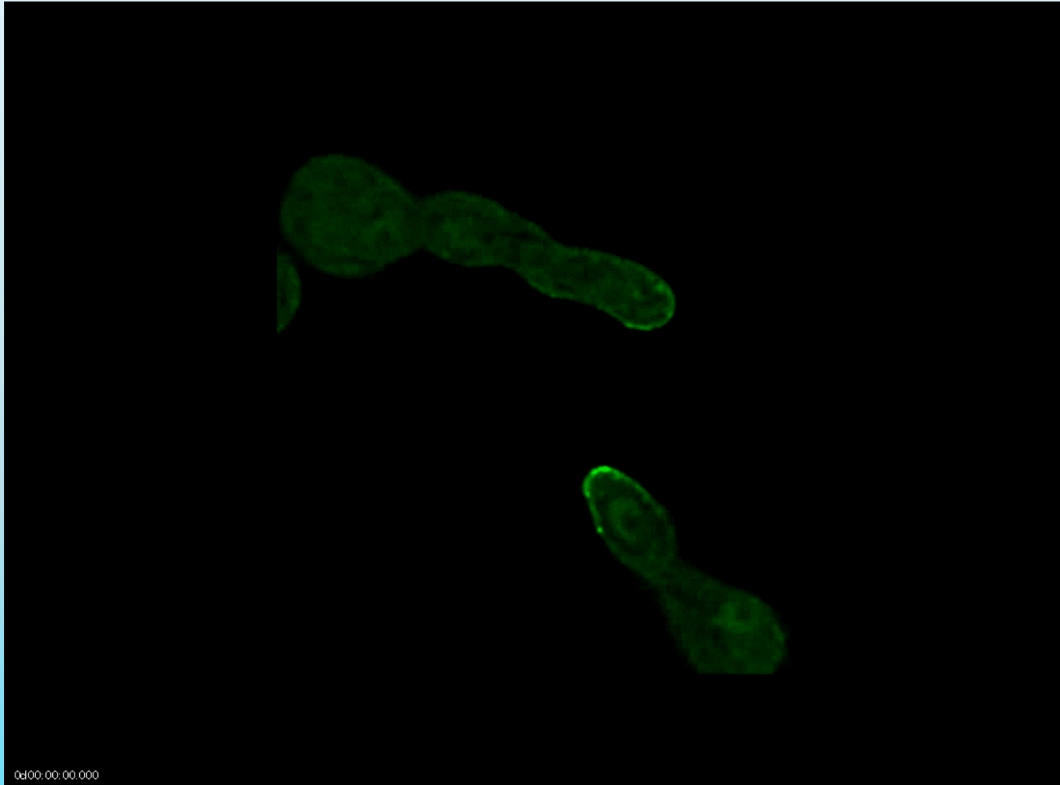
Hyphal-network resulting from fusion



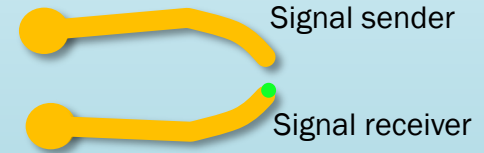
The MAP kinases MAK-1 and MAK-2 are essential for germling interactions



MAK-2 is recruited to germling tips in an oscillating manner

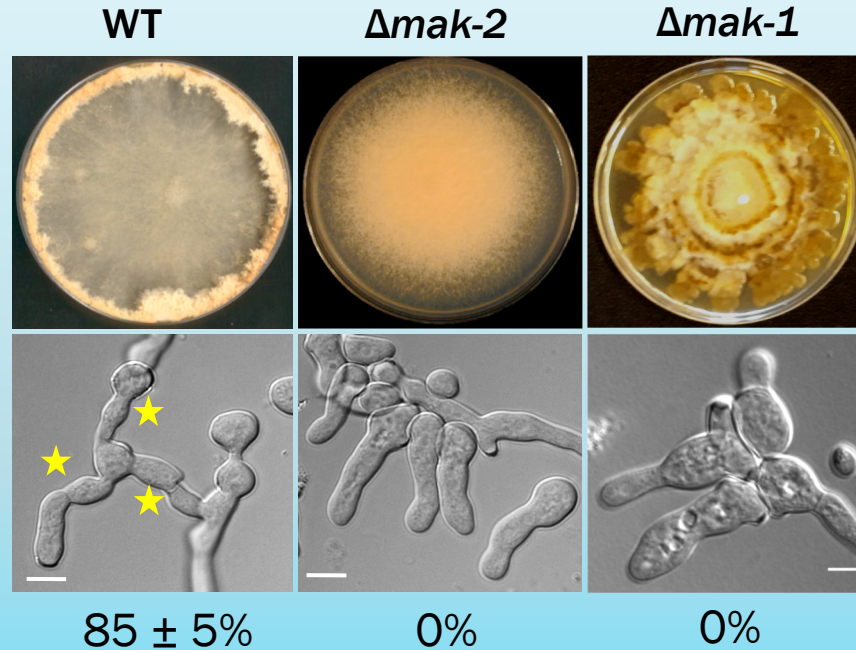


Communication

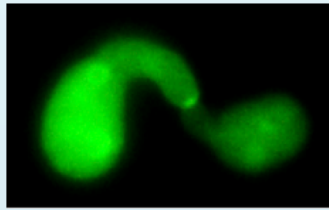


Cell dialogue → Fusion

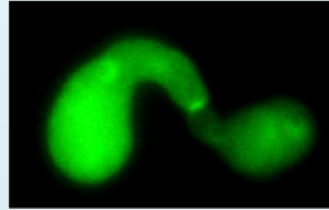
The MAP kinases MAK-1 and MAK-2 are essential for germling interactions



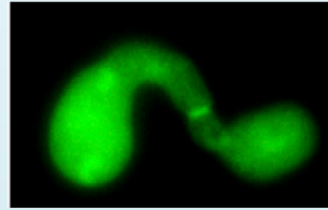
MAK-1 does not localize during cell-cell communication but localizes at the contact point



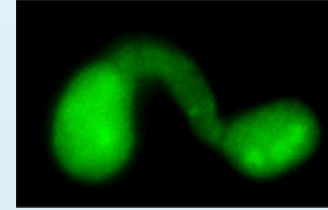
0 min



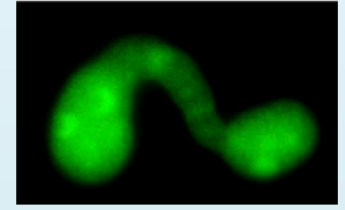
2'



4'

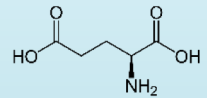


6'



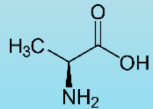
8'

Chemical genetics: Analog sensitive kinases can be specifically inhibited by a bulky ATP analog

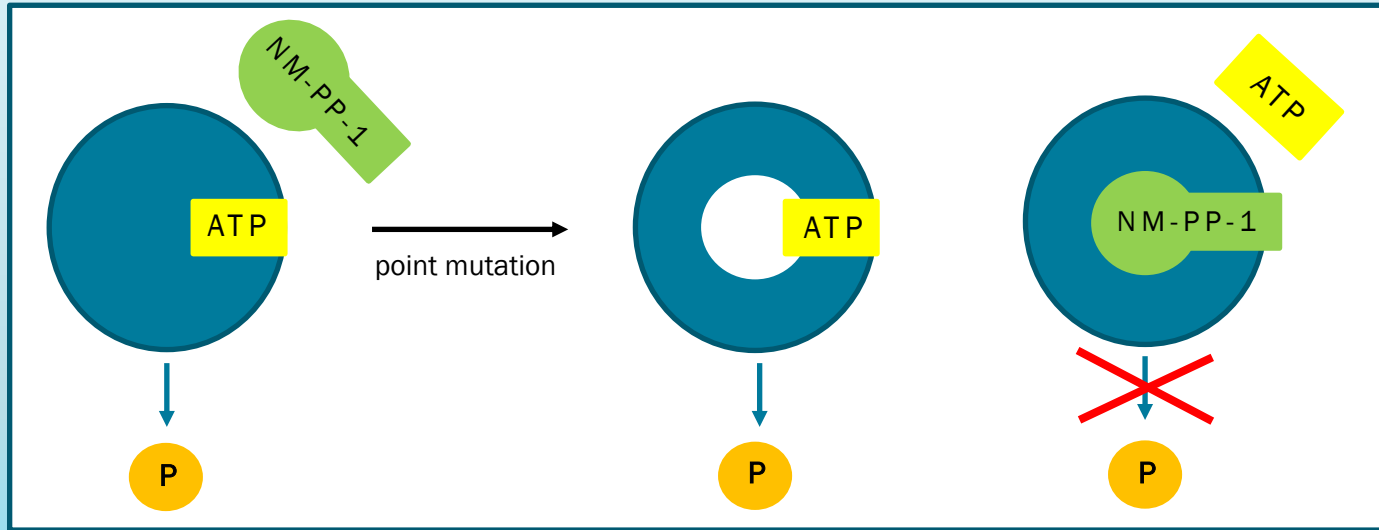


Glutamic acid

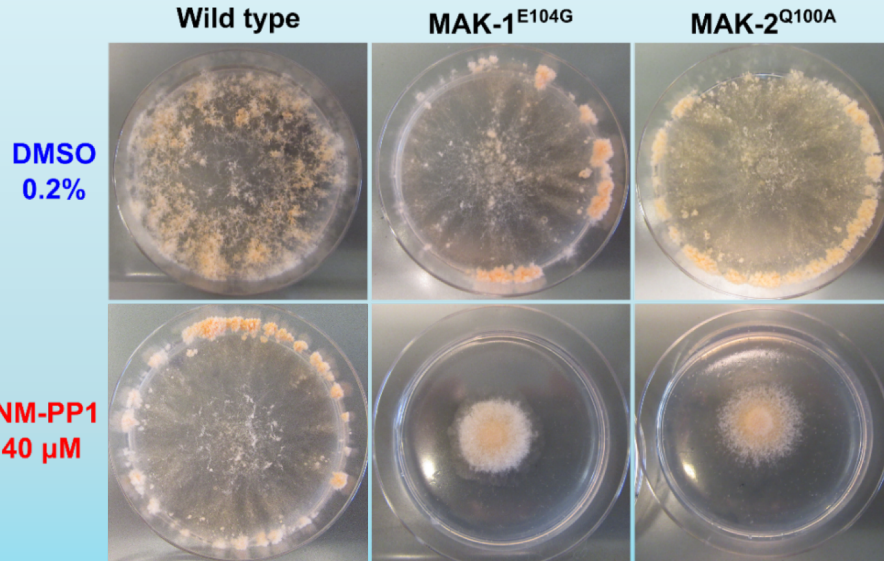
point
mutation



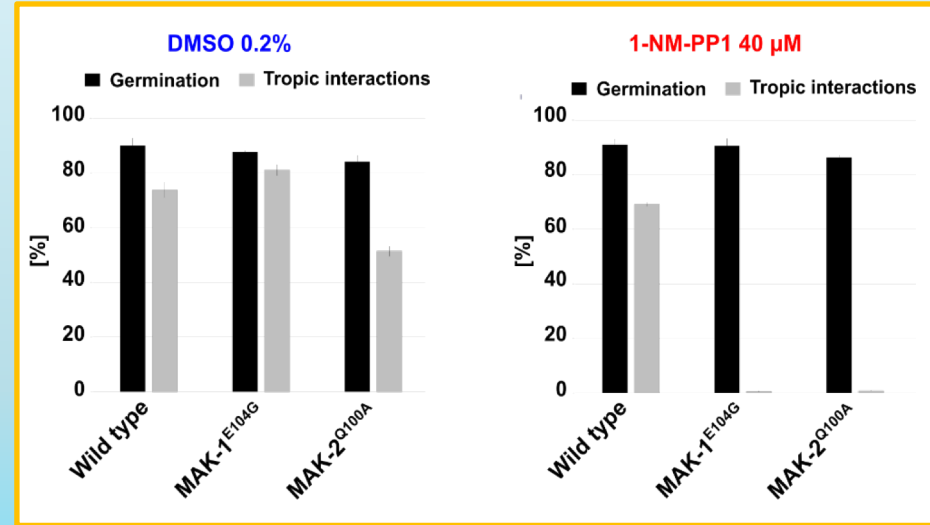
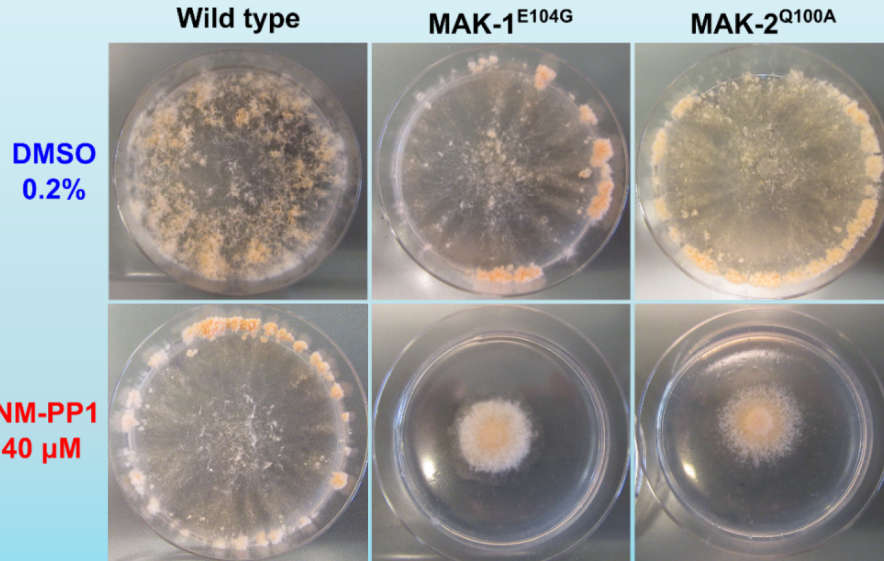
Alanin



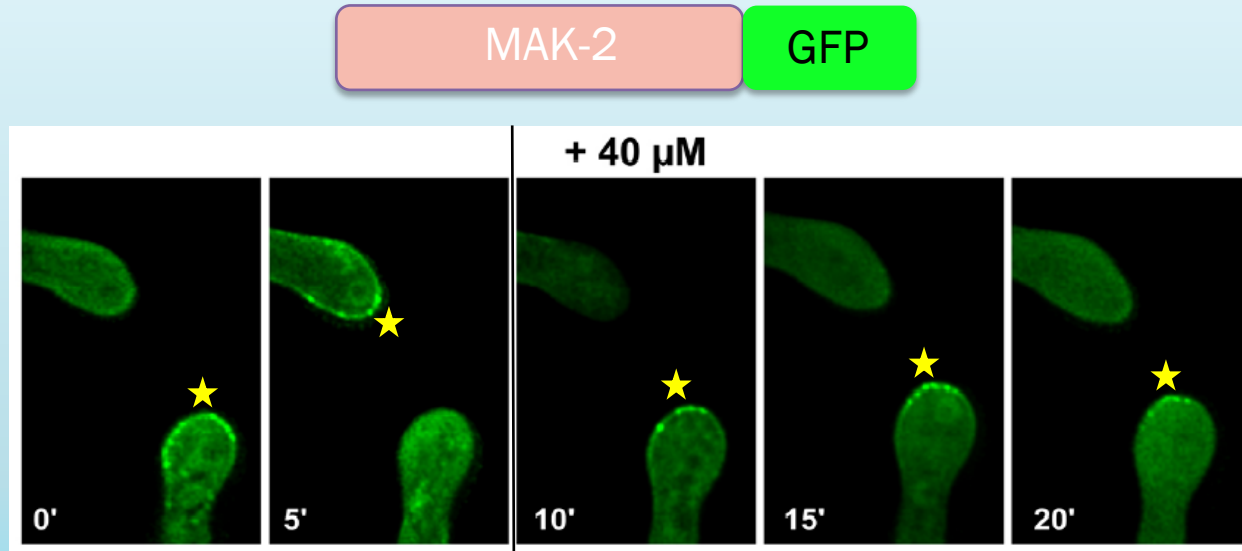
Chemical inhibition of either MAK-1 or MAK-2 disrupts tropic interactions



Chemical inhibition of either MAK-1 or MAK-2 disrupts tropic interactions



Chemical inhibition of MAK-2 interrupts the cell-dialogue



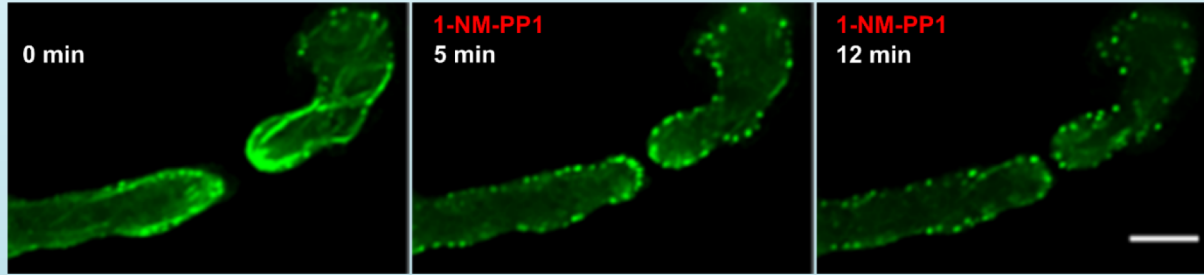
MAK-1 and MAK-2 have distinct functions during the interaction process

Lifeact-GFP

MAK-1 and MAK-2 have distinct functions during the interaction process

Lifeact-GFP

mak-1^{E104G}

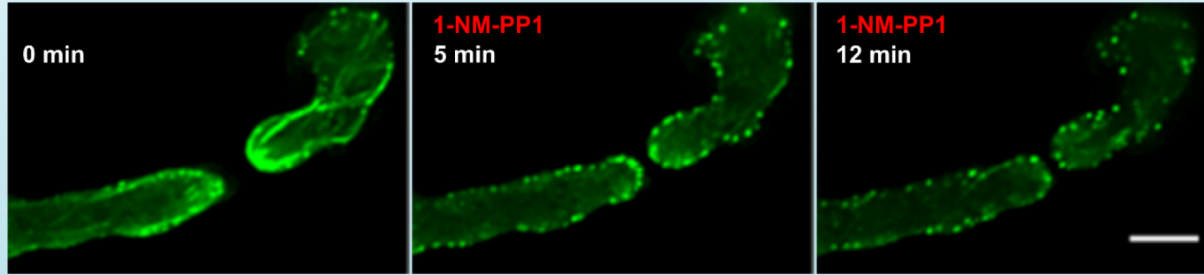


Actin-cables vanish,
actin-patches stay

MAK-1 and MAK-2 have distinct functions during the interaction process

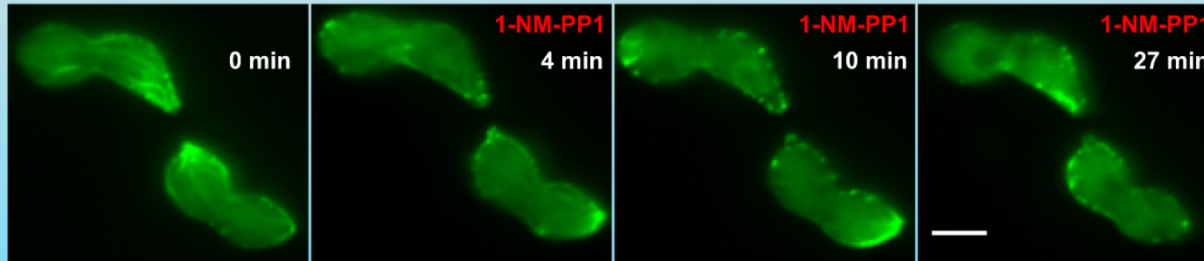
Lifeact-GFP

mak-1^{E104G}



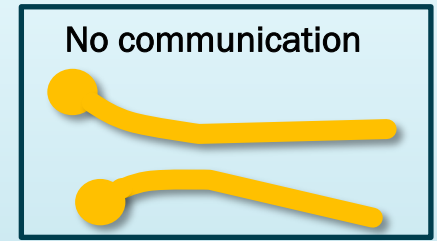
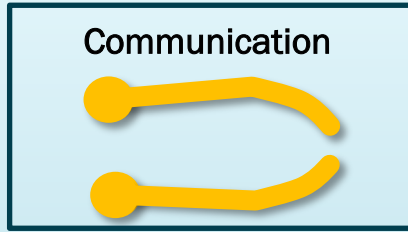
Actin-cables vanish,
actin-patches stay

mak-2^{Q100A}

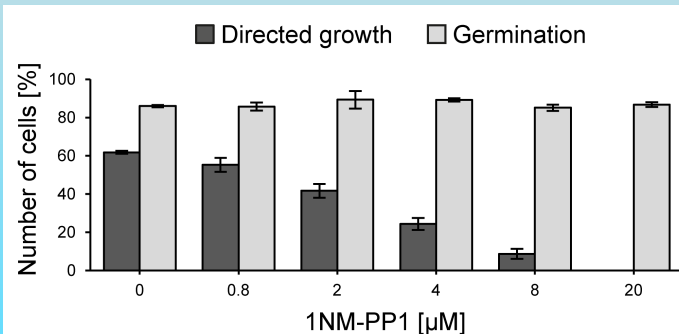
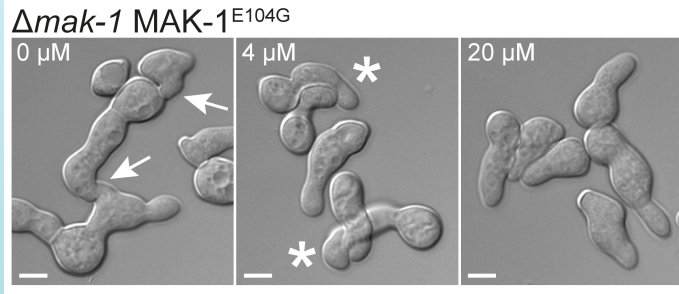
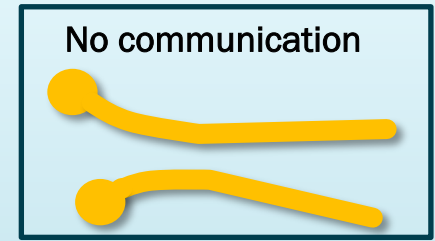
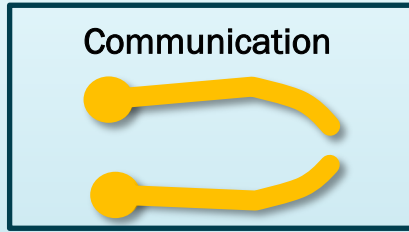


Actin-cables change
their location

MAK-1 activity is required for cell-cell contact recognition



MAK-1 activity is required for cell-cell contact recognition



MAK-1 activity is required for cell-cell contact recognition

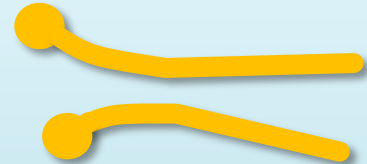
Communication



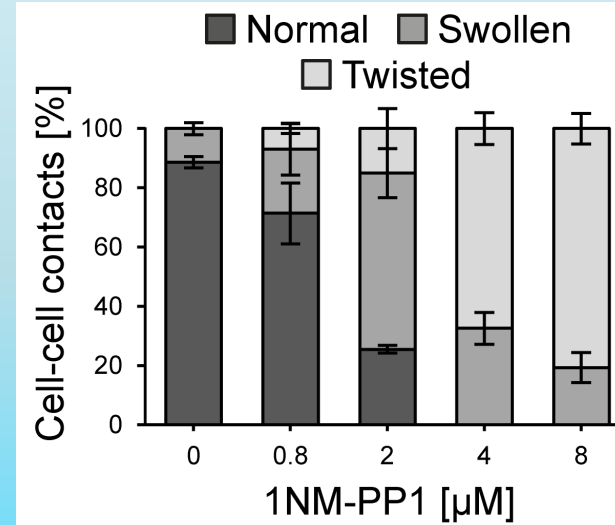
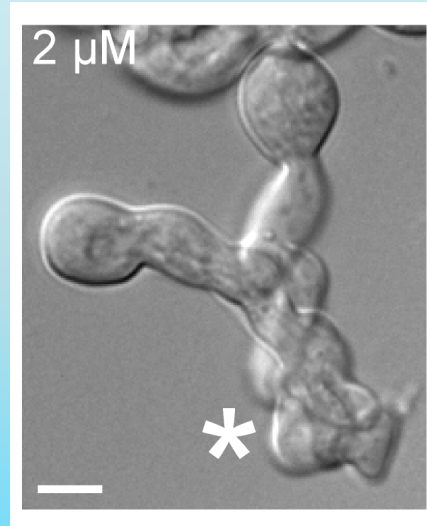
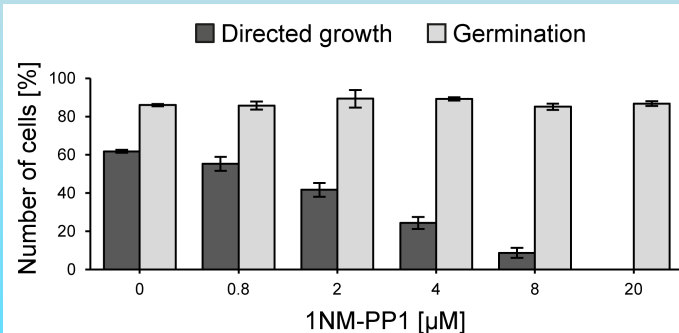
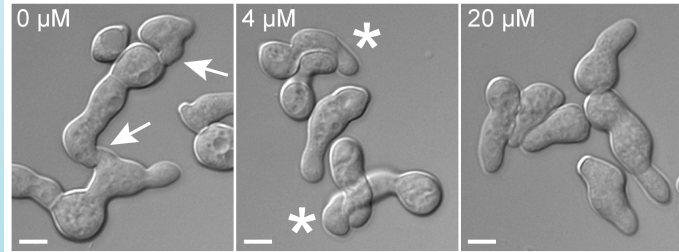
No contact recognition



No communication

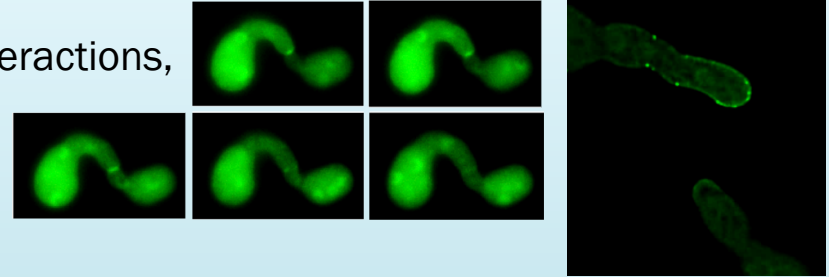


$\Delta mak-1$ MAK-1^{E104G}

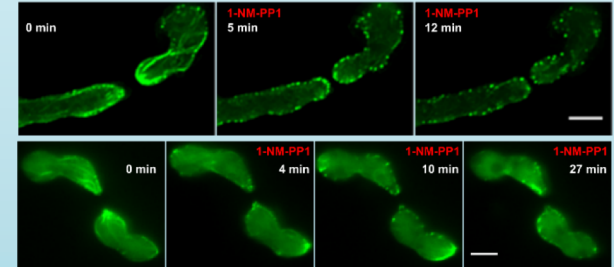


Conclusion

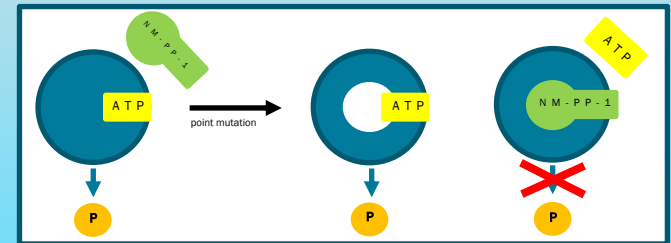
- MAK-1/MAK-2 are both essential for cell-cell interactions, but have distinct functions in the process



- MAK-2: Cell-dialogue; Focus of actinaster
MAK-1: Cell-recognition; Stabilization of actincables



- Chemical genetics has outstanding potential for investigation of kinases





Technische
Universität
Braunschweig

Department
of Genetics

André Fleißner

Ulrike Brandt

Martin Weichert

Antonio Serrano

Stephanie Herzog

Hamzeh Haj Hammadeh

Marcel Schumann

Marco Leiterholdt

Sofie Friedrich

Linda Matz

Anne Oostlander

Herbert Raditya

Bianca Sieg

Jonathan Benecke

Hannah Knobel

Anne Scheler

Till Wittemann

Simone Karrie



Marie Curie Actions
Program of the European
Union



Niedersächsisches Ministerium
für Wissenschaft und Kultur