

DECODING LIGAND-RECEPTOR SPECIFICITIES of LysM- PROTEINS IN PLANT IMMUNITY AND SYMBIOSIS (SIPIS)

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Action in Plant Sciences



PARTNERS

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SIPIS aims

- Novel strategies for crop improvement and protection aim at enhancing host recognition capacities for potential pathogens
- Interfering with virulence strategies employed by microbial pathogens
- Taking advantages of natural symbioses.

LysM-type immune receptors mediate sensing of microbe-derived patterns

- sensing of microbe-derived patterns chitin or peptidoglycan mediates plant immunity to fungal or bacterial infection
- LysM-type receptor recognition of lipochitooligosaccharides establishes root symbioses with rhizobia or mycorrhizal fungi

Objectives

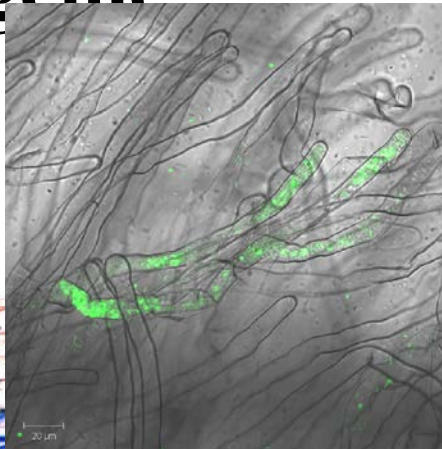
- **(I)** Elucidation of the structural determinants within LysM proteins that govern ligand specificities and affinities by means of protein X-ray analysis and comprehensive analysis of LysM protein ligand affinity measurements
- **(II)** LysM receptor-ligand complex architecture and stoichiometry analysis by advanced biochemical and protein microscopical techniques

Objectives

- **(III)** Molecular analyses of LysM receptor-mediated transmembrane signaling, intra- and intercellular signal generation by means of state-of-the-art biochemical and genetic approaches
- **(IV)** Exploitation of 3D-structural information of LysM receptors for computational drug design strategies that aim at isolating agonists of plant immunity.

Beneficial or pathogenic?

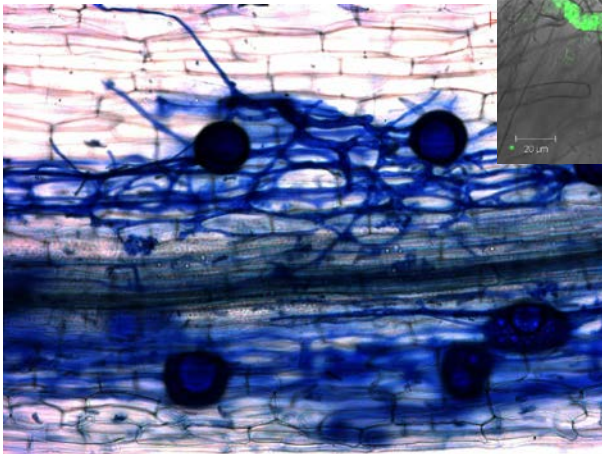
Endophytic association



Fungal disease



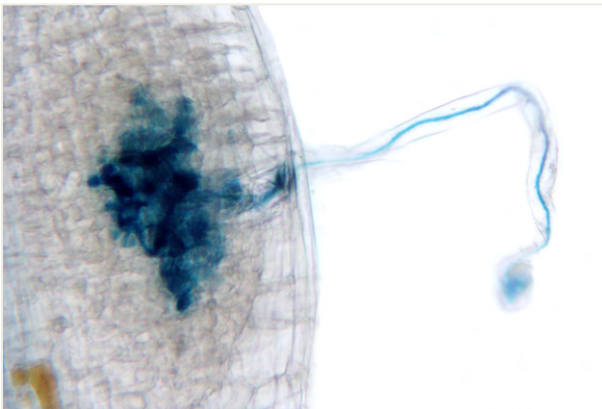
Arbuscular mycorrhiza symbiosis



Nematode attack

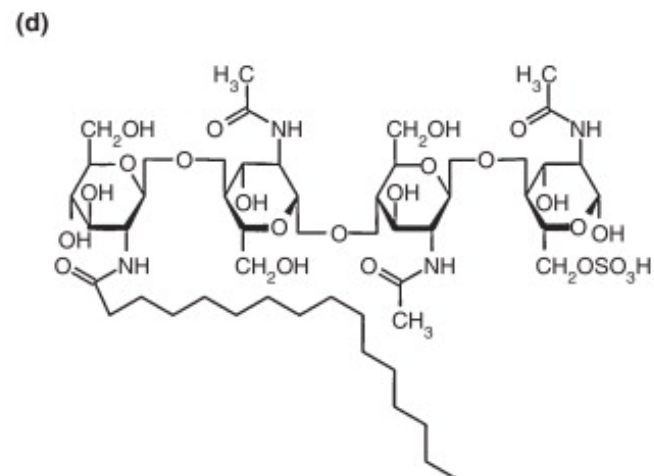
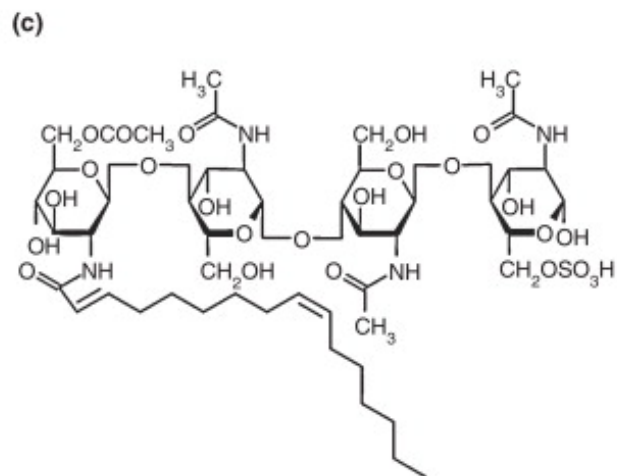
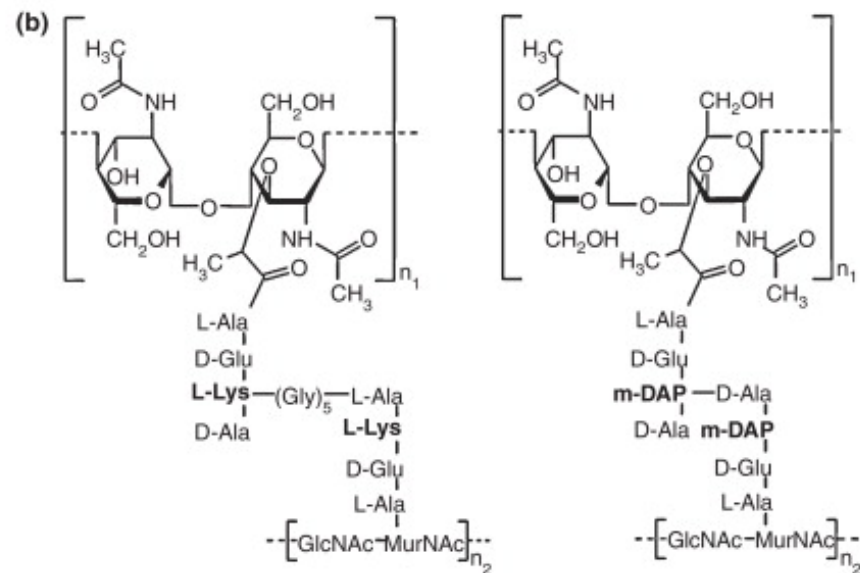
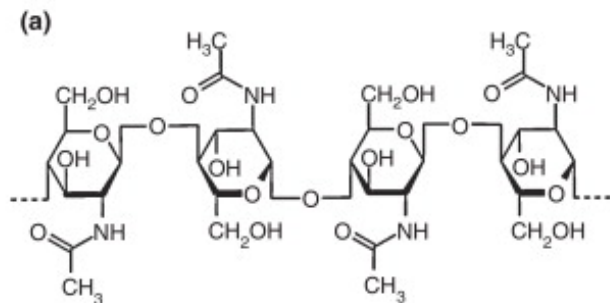


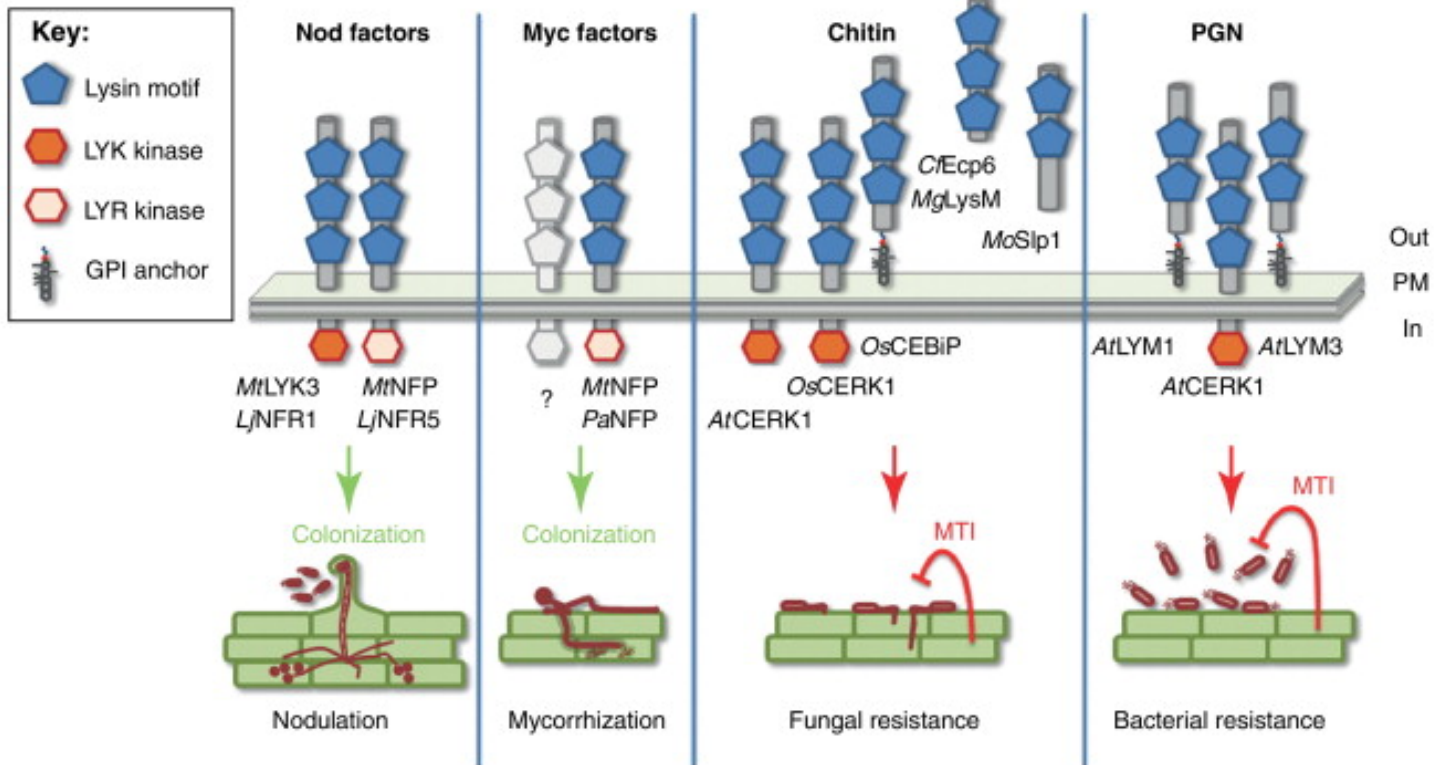
Rhizobium symbiosis



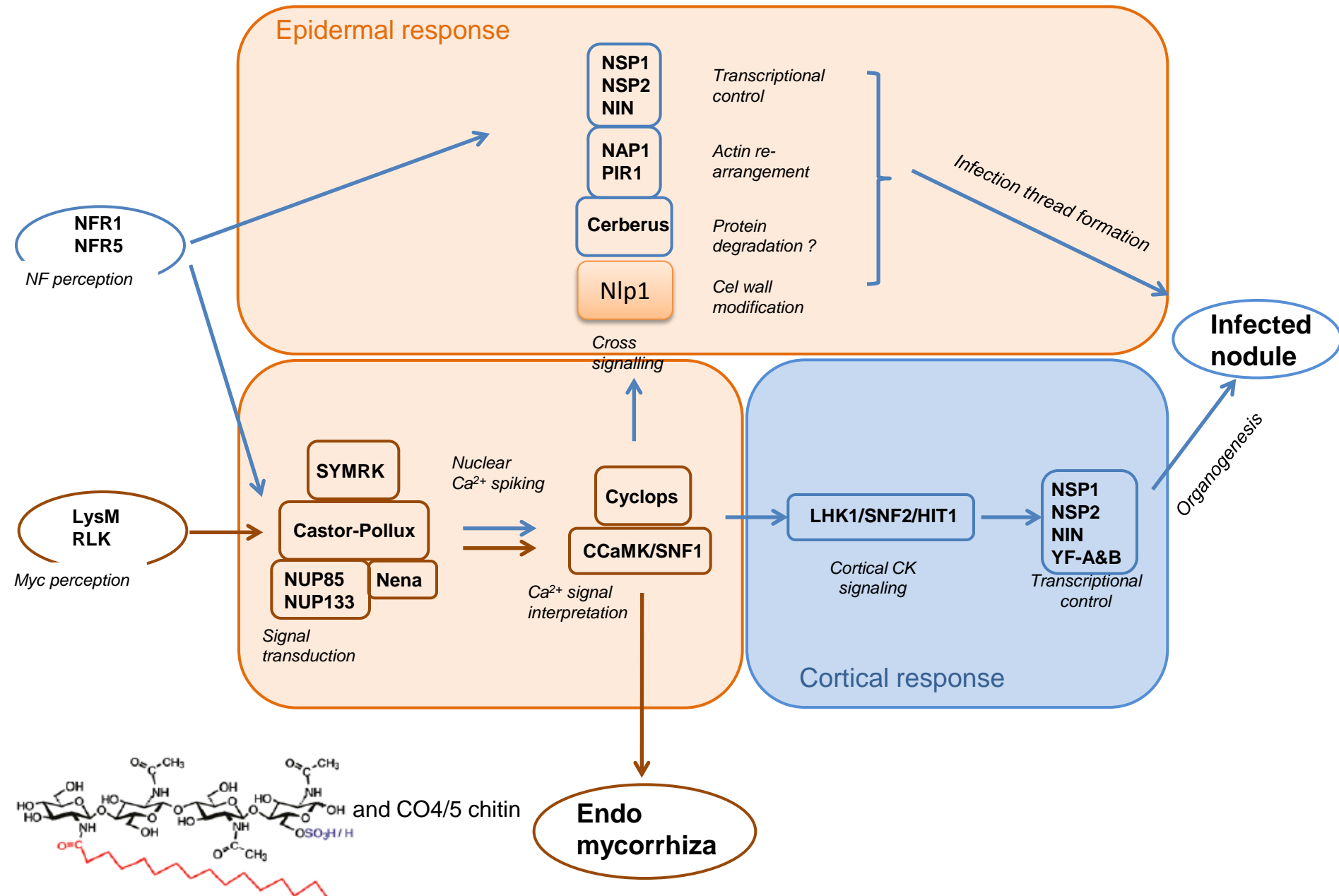
Bacterial disease







Summary of nod factor perception and downstream signal transduction



LysM proteins implicated in bacterial peptidoglycan-mediated immunity in Arabidopsis

Prof. Dr. Thorsten Nürnberger

Dept. of Plant Biochemistry, Center of PLant Molecular Biology,
Eberhard-Karls-University Tübingen, Tübingen, Germany (DE)

Expertise:

- Peptidoglycan perception and signal transduction in *Arabidopsis thaliana*
 - Structural and functional analysis of plant immune receptors
 - Molecular phytopathology

Aims within SIPIS:

- Identification of structural determinants governing LysM protein ligand specificities
 - Peptidoglycan tripartite receptor complex assembly
 - Elucidation of LysM protein-mediated intercellular signalling
- 3D-structure-aided peptidoglycan agonist design for artificial immune activation

Expertise:

- Secreted fungal effectors that contribute to disease development
 - Pathogen genomics and evolution of pathogenicity
 - Molecular Phytopathology

Aims within SIPIS:

- Elucidation of structural determinants governing biological functions of LysM effectors
- Elucidation of structural determinants within LysM effectors governing ligand specificities
 - Analysis of chimeric LysM receptors containing LysM effector domains
- 3D-structure-aided design of antagonists of effector-mediated chitin sequestration

Function, localization and signalling of *Arabidopsis thaliana* LysM proteins.

Dr. Simone Ferrari

Dept. of Biology and Biotechnologies "Charles Darwin ", University of Rome Sapienza, Rome (ITALY)

Expertise:

- Molecular biology and genetics of *Arabidopsis thaliana*
- Activation of plant innate immunity during bacterial and fungal infections
- Proteomics and cell biology of plant responses to pathogens

Aims within SIPIS:

- Structural and functional characterization of AtLysM-RLK2
- Complex formation of AtLysM-RLK2 and intracellular signalling
- Subcellular localization and trafficking of AtLysM-RLK2 and other LysM proteins

LysM proteins implicated in chitin signaling in Arabidopsis immunity

Prof. Dr. Volker Lipka

Dept. of Plant Cell Biology, Georg-August-University Göttingen, Göttingen, Germany (DE)

Expertise:

- Chitin perception and signal transduction in *Arabidopsis thaliana*
- Pre- and postinvasion defense mechanisms against fungal pathogens
 - Cell Biology of Plant-microbe interaction

Aims within SIPIS:

- Identification of structural determinants governing LysM protein ligand specificities
- Analysis of AtCERK1 dimerization, receptor complex architecture and dynamics of assembly
 - Elucidation of LysM protein-mediated intercellular signalling at plasmodesmata

Prof Jens Stougaard

Department of Molecular Biology and Genetics, Aarhus University, Denmark

Expertise:

Nod factor perceptions symbiotic receptors

Activation of the plant pathways regulating root nodule organogenic and infection

Aims within SIPIS:

Structure-function analysis of the NFR1 and NFR5 LysM domains

NFRs and LysM-RLK receptor complexes and binding partners.

The *in vivo* phosphorylation pattern of the *Lj*NFR1, *Lj*NFR5 and *Lj*LysM-RLKs

SIPIS

Start up meeting in June



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