# Integration of Nutritive Functions

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Adeline Mauries
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# Topic: Mechanisms governing root $NO_3^-$ uptake

Arabidopsis

Systemic

N status C status

$NO_3^-$

Local

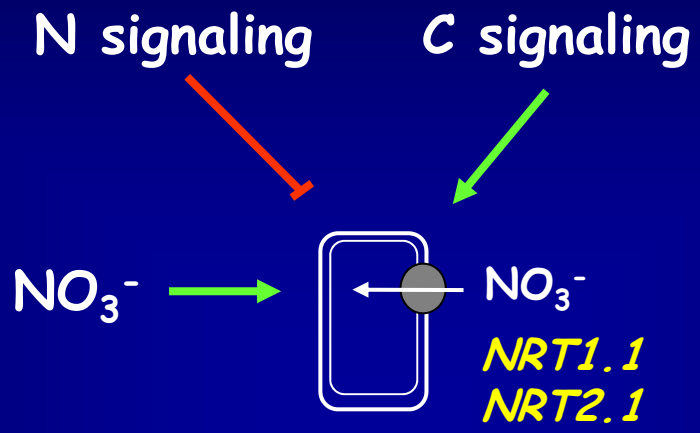
$NO_3^-$

Root development

Transporters

# Strategies

Candidate transporter genes




Expression studies (mRNA)
Functional characterization
Signaling mechanisms

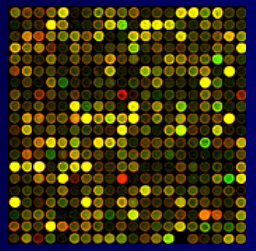
Systems Biology
Modeling gene networks
G. Krouk, L. Lejay, S. Ruffel

Proteomics
NRT2.1
L. Lejay

Large scale
Functional characterization
NRT1/PTR family
B. Lacombe

# Strategies

## Transcriptomics

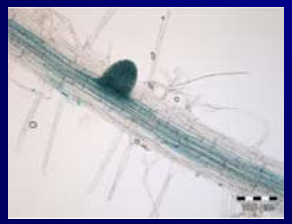


+/- N
Mutants *nrt1.1*

$NO_3^-$

NRT1.1 = senseur

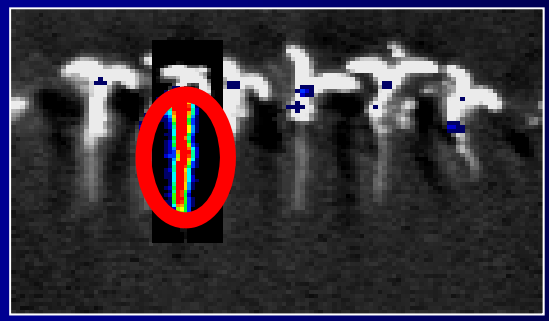
Signal



Lateral root development
P. Nacry

## Forward genetics

*pNRT2.1::LUC*



*high nitrogen insensitive* (*hni*) mutants

HNI9
Chromatine Dynamics
A. Martin

*hni48*
*Hni140*
*S. Ruffel*

Posttranslational regulation of NRT2.1 — L. Lejay

Functional characterization of NRT1/PTR — B. Lacombe

NRT1.1-dependent regulation of lateral root growth — P. Nacry

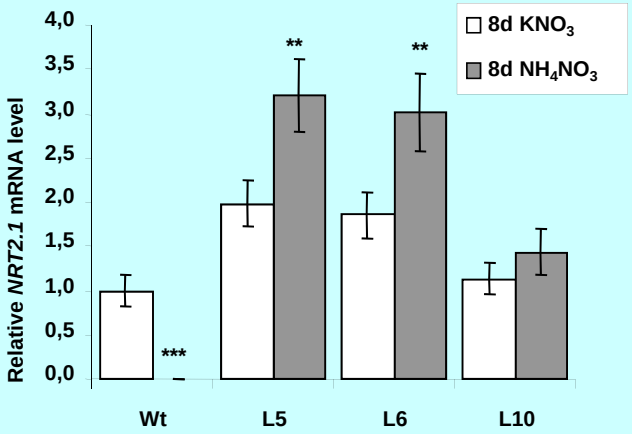
3 x 10 min

S. Ruffel
G. Krouk
A. Martin

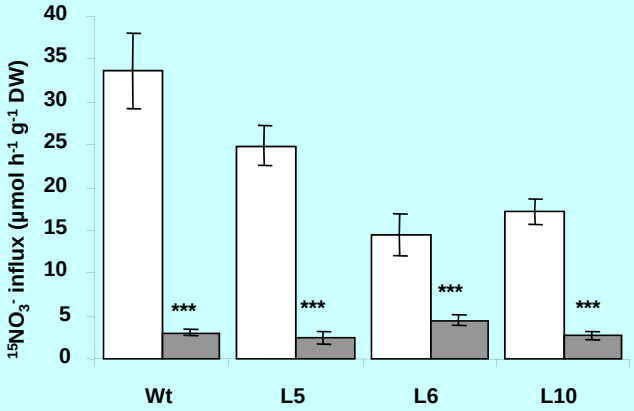
# NRT2.1 post-translational modifications

## *35S::NRT2.1* dans KO *nrt2.1*

**A- qPCR *NRT2.1***




**B- Influx $NO_3^-$**




*Laugier et al. 2012*

## Detection of 4 phosphorylation sites

**S11**

**(N ter) M.GDSTGEPGSSMHGVTGR.E**

**S28**

**R.EQSFAFSVQSPIVHTDK.T**

**S501**

**K.NMHQGSLRFAENAK.S**

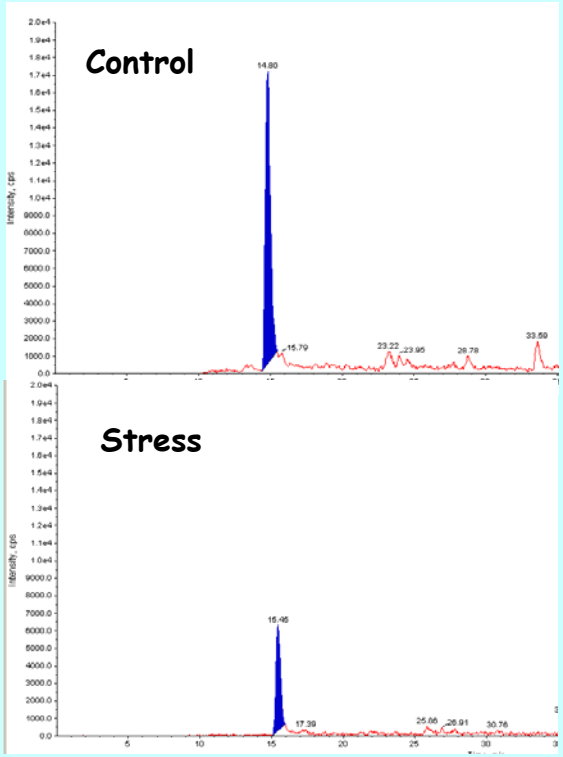
**T521**

**R.SAATPPENTPNNV.- (C-ter)**

E. Bouguyon
E. Laugier
L. Lejay
A. Mauries
P. Tillard

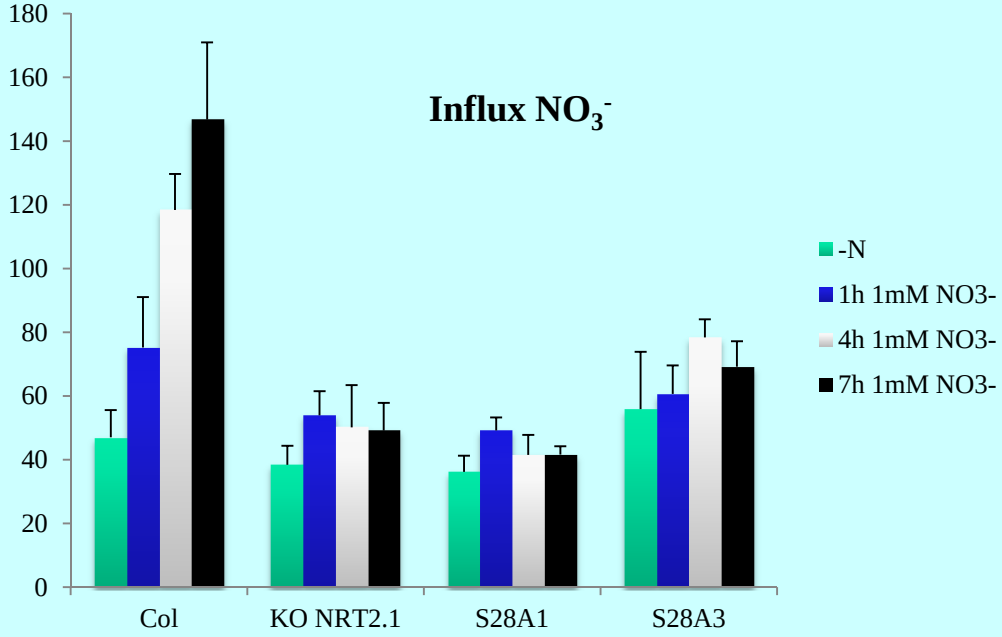
# NRT2.1 post-translational modifications

## Quantification of the 4 phospho-peptides



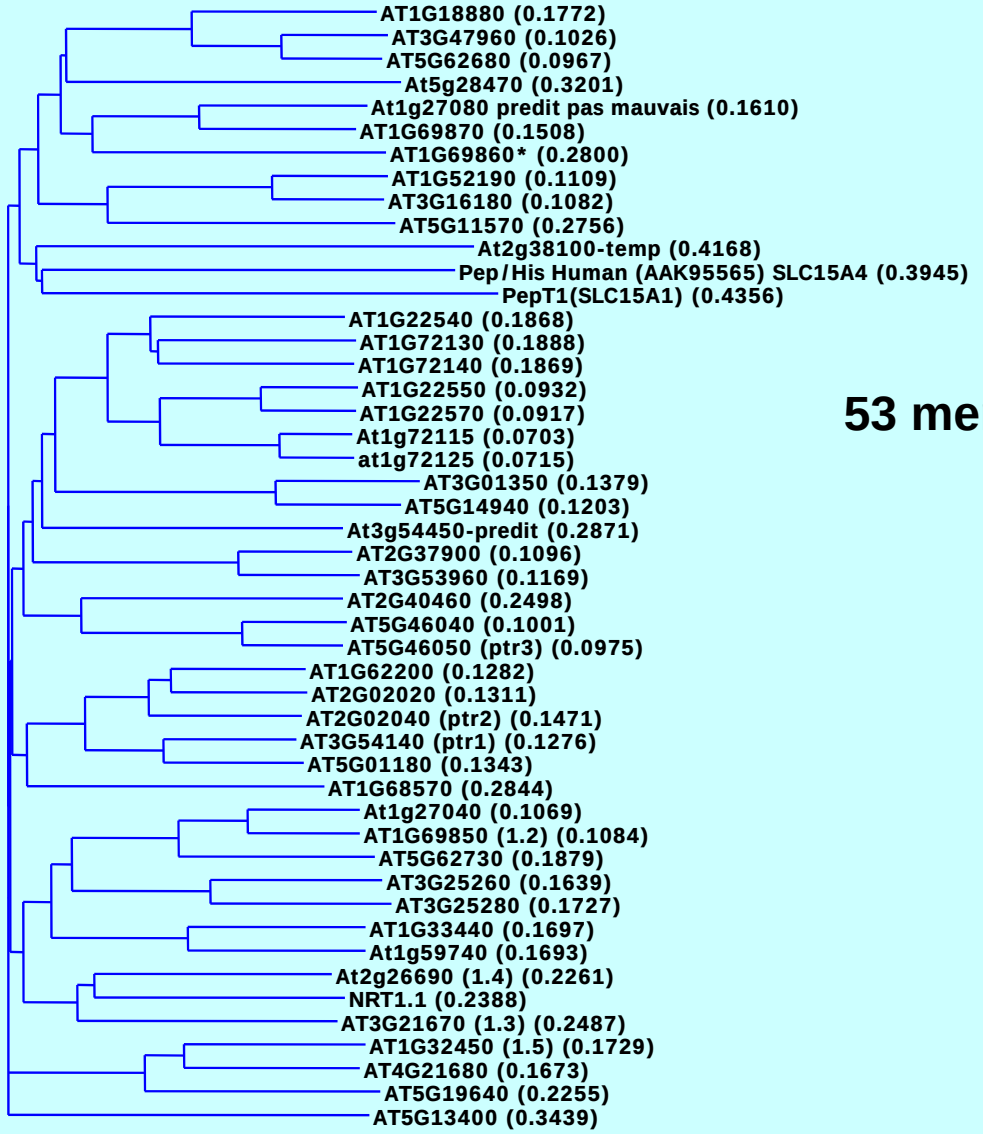

## Fonctional impact of the phosphorylations

### Mutation of the phosphorylation sites



# 1- Quelles molécules sont transportées par les NRT1/PTR ?

## La famille PTR/NRT1 chez Arabidopsis



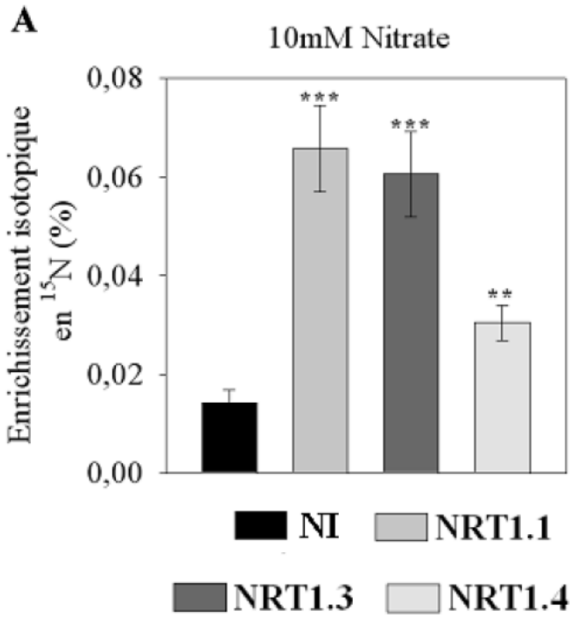

**53 membres chez Arabidopsis :**

- **1 transporteur nitrate /auxine**
- **1 transporteur nitrate/ABA**
- **2 transporteurs glucosinolates**
- **8 transporteurs de nitrate**
- **4 transporteurs de peptide**

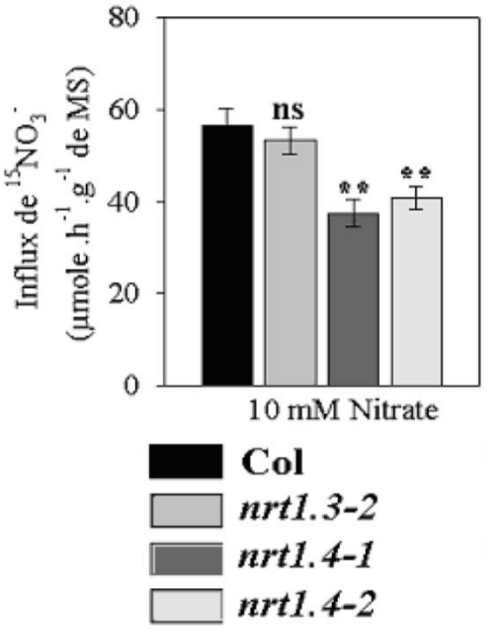

Y. Boursiac
C. Brachet
C. Corratgé-Faillie
B. Lacombe
S. Leran
P. Tillard

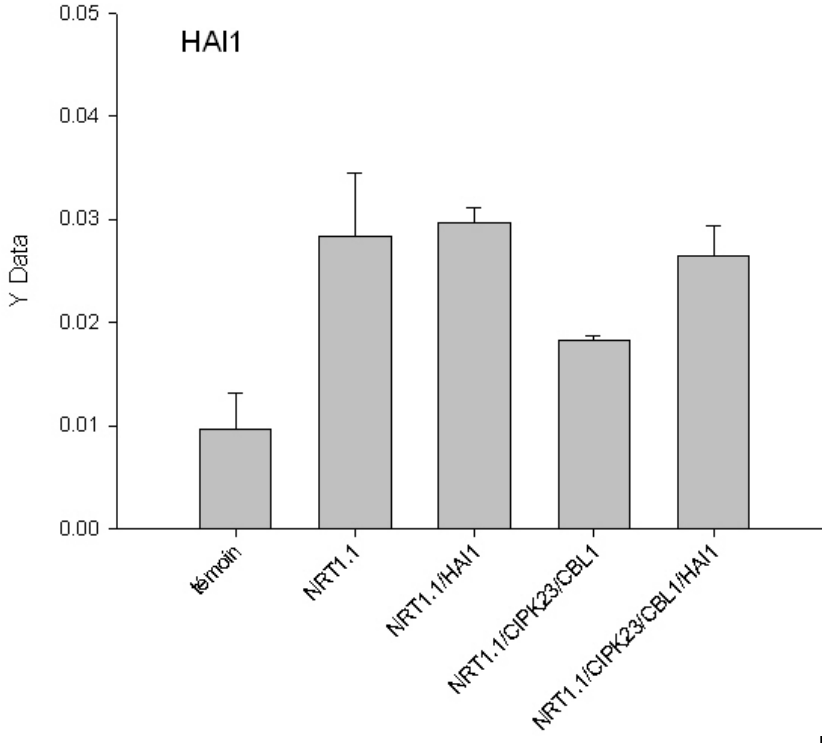
# 1- Substrats et régulation des NRT1/PTR

## Ovocytes de Xénope




## Plantes

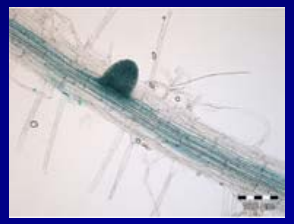



- **Régulation par kinases/phosphatases**
- **Co expression NRT1.1/CIPK/CBL/PP2C**

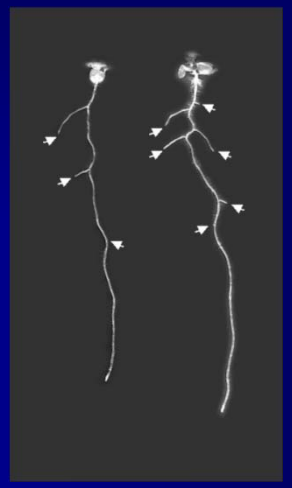
# A model for $NO_3^-$ regulation of root growth by NRT1.1-dependent auxin transport

$NO_3^-$ +

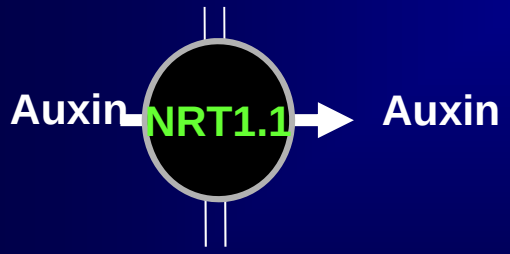


- $NO_3^-$

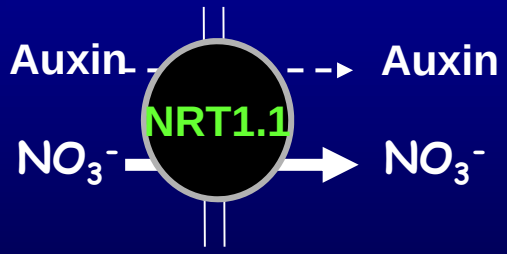
Col *chl1*

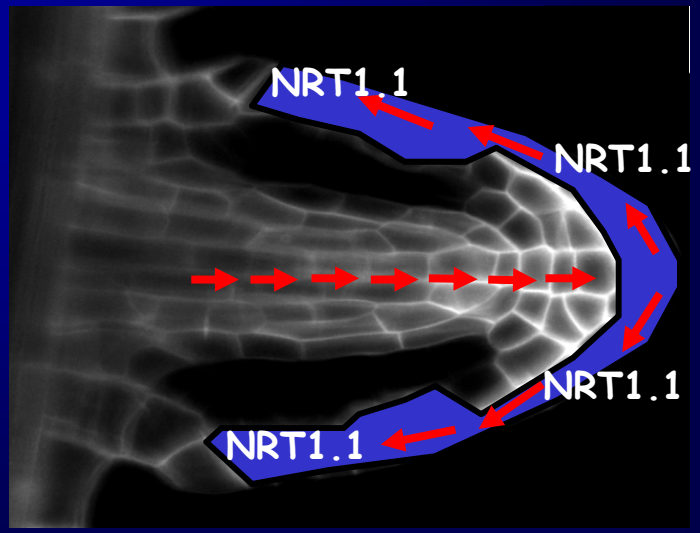


Low $NO_3^-$




High $NO_3^-$

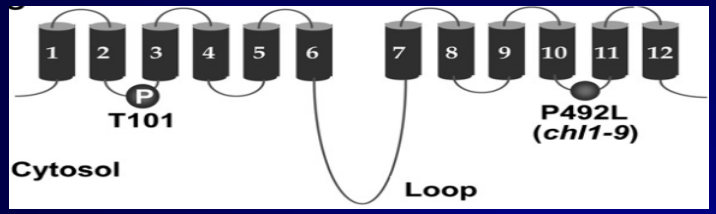


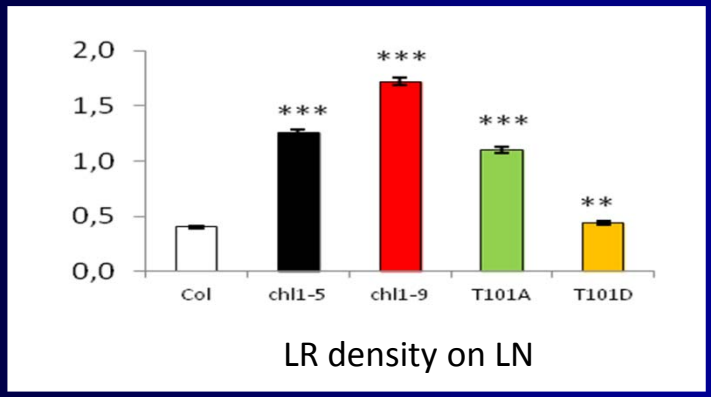




NRT1.1::GFP Expression Zone

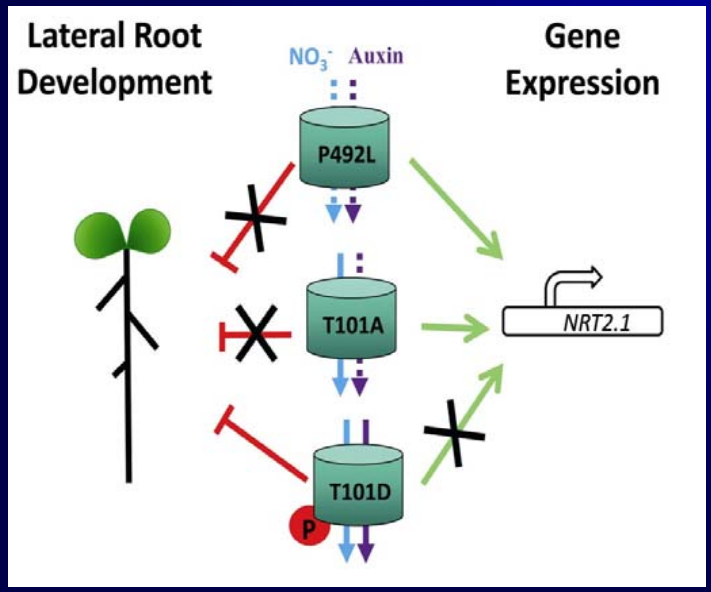
*Krouk et al. 2010*

# Uncoupling signaling functions of NRT1.1



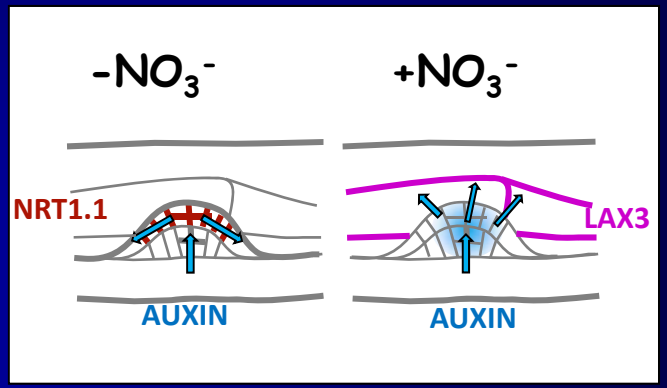



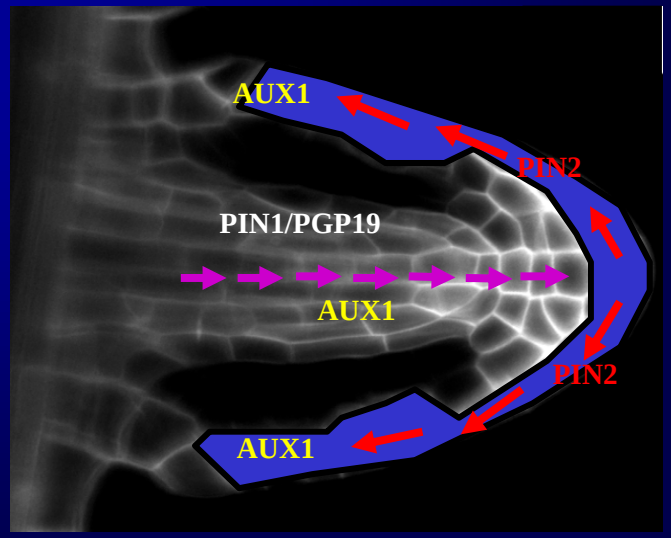

LR density on LN




E. Bouguyon
E. Mounier
P. Nacry
F. Perrine-Walker
M. Pervent

## Effect of $NO_3^-$ and NRT1.1 on auxin trafic and auxin carriers




NRT1.1::GFP Expression Zone

Nouveaux mots-clés d'Intégration en 2013:

-Facteurs de transcription

-Kinases/phosphatases

-Adaptation des plantes au changement climatique: $CO_2$

*-Développement racinaire/hormones/signalisation N??*

Collaborations intra-BPMP:

-Aqua/Canaux: Nitrate/potassium/eau, Développement racinaire

-FEROS: Biologie des systèmes

-Métaux: Ovocytes/Isotopes, Biologie des systèmes

-Signalisation électro-calcique: Kinases