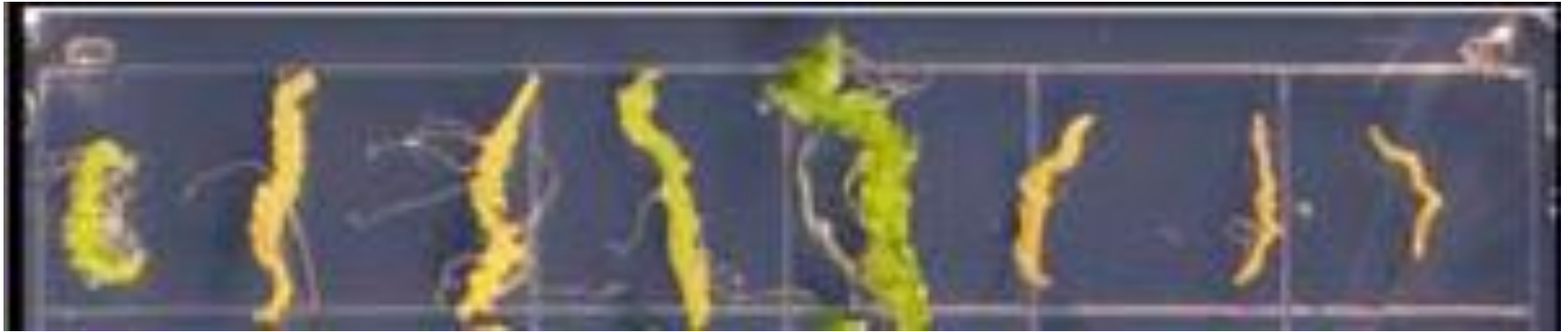


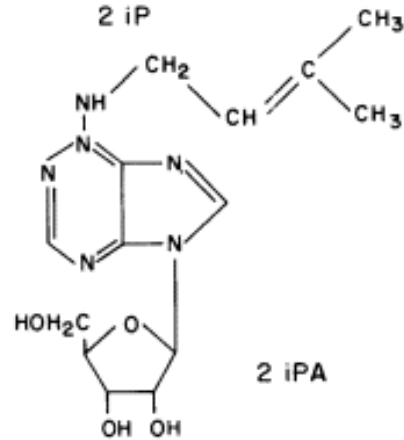
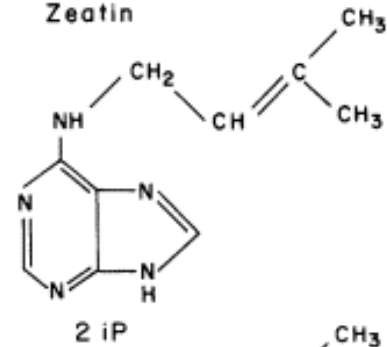
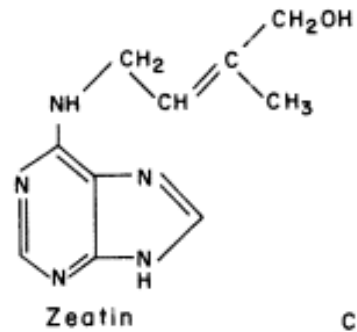
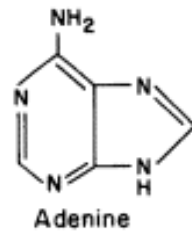
Role of cytokinin in plant development

Cytokinin – substance crucial for sustain of cell proliferation

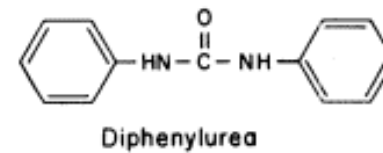
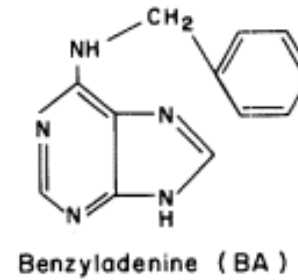
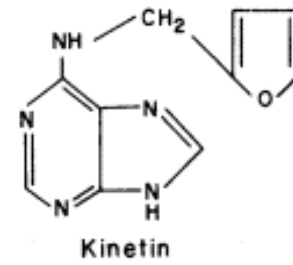


Cytokinins

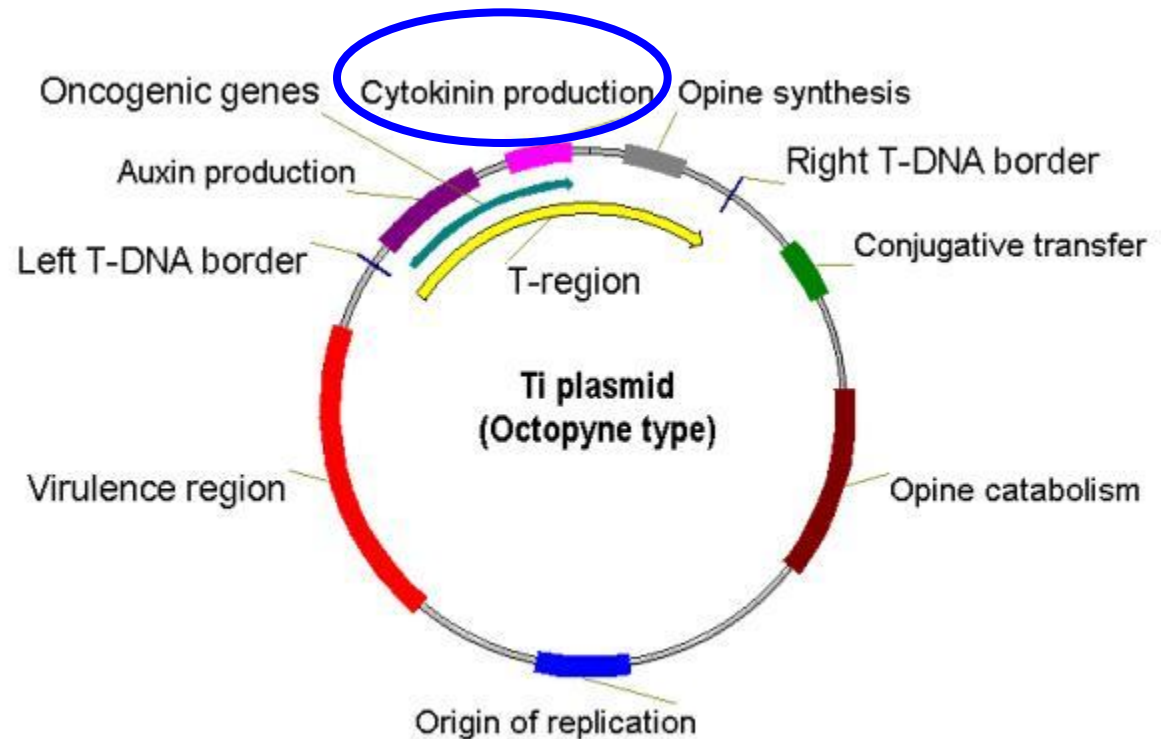
Native



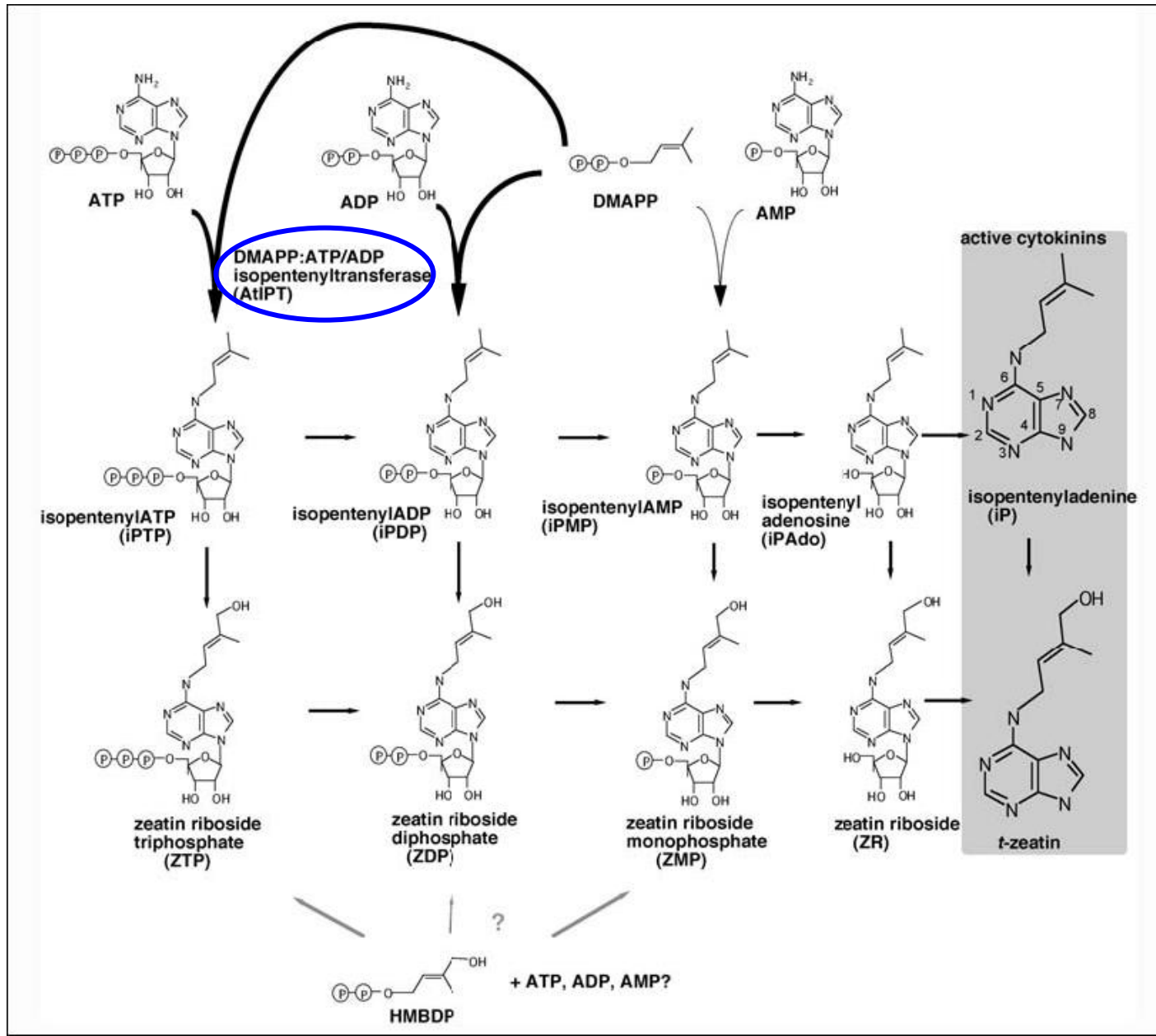
Synthetic



Agrobacterium tumefaciens – IPT (isopentenyltransferase) gene for cytokinin biosynthesis



Cytokinin biosynthesis



Arabidopsis *IPT*s (8)

Differential expression patterns

Differently responsive promoters
(cytokinin, auxin, nitrate, combinations)

mutants, overexpression ???

CYTOKININ - Metabolism

Synthesis – *IPT* genes

Degradation – CK-oxidase

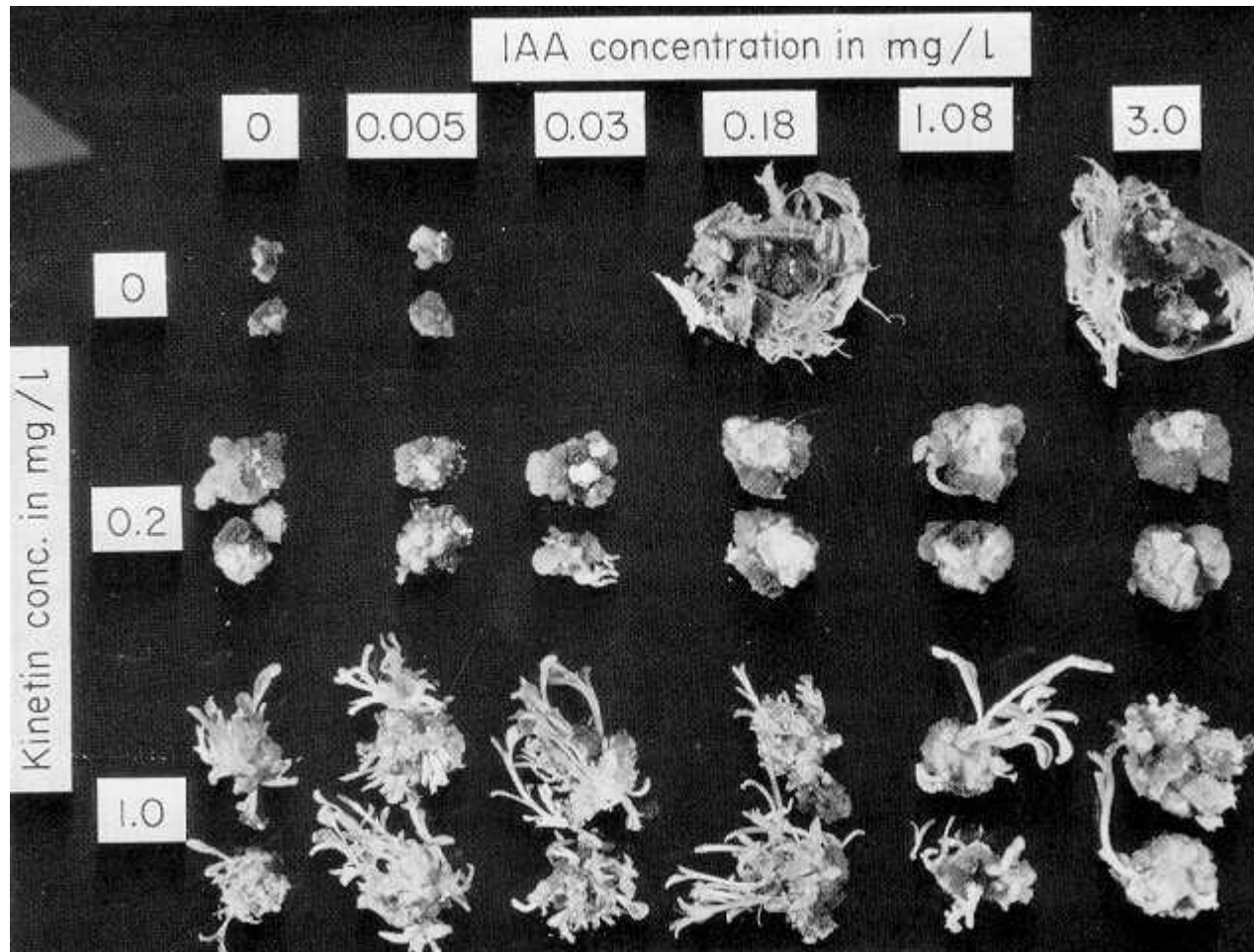
Conjugation

Cytokinin – role in plant development

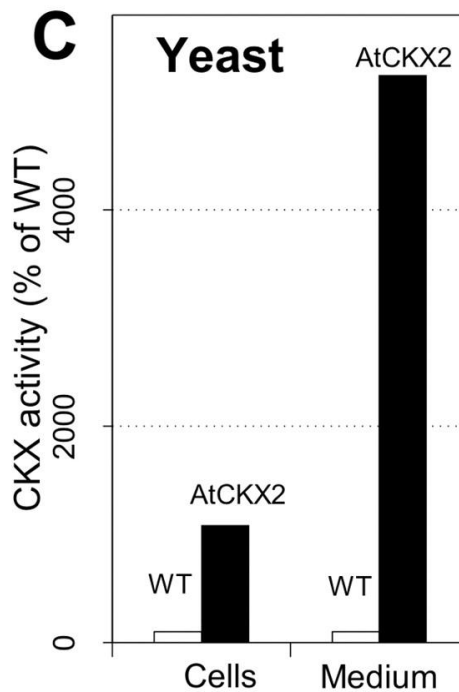
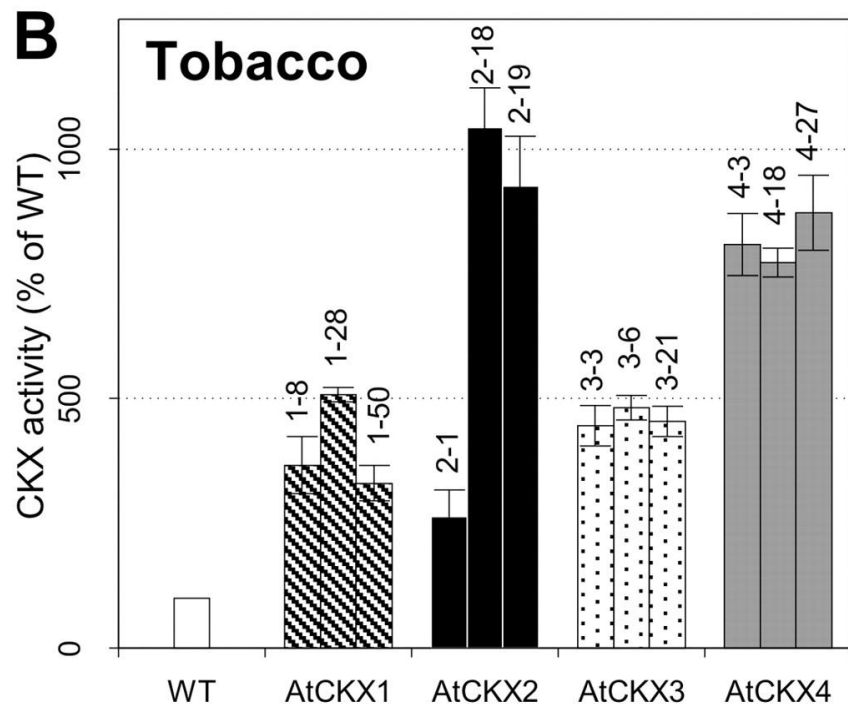
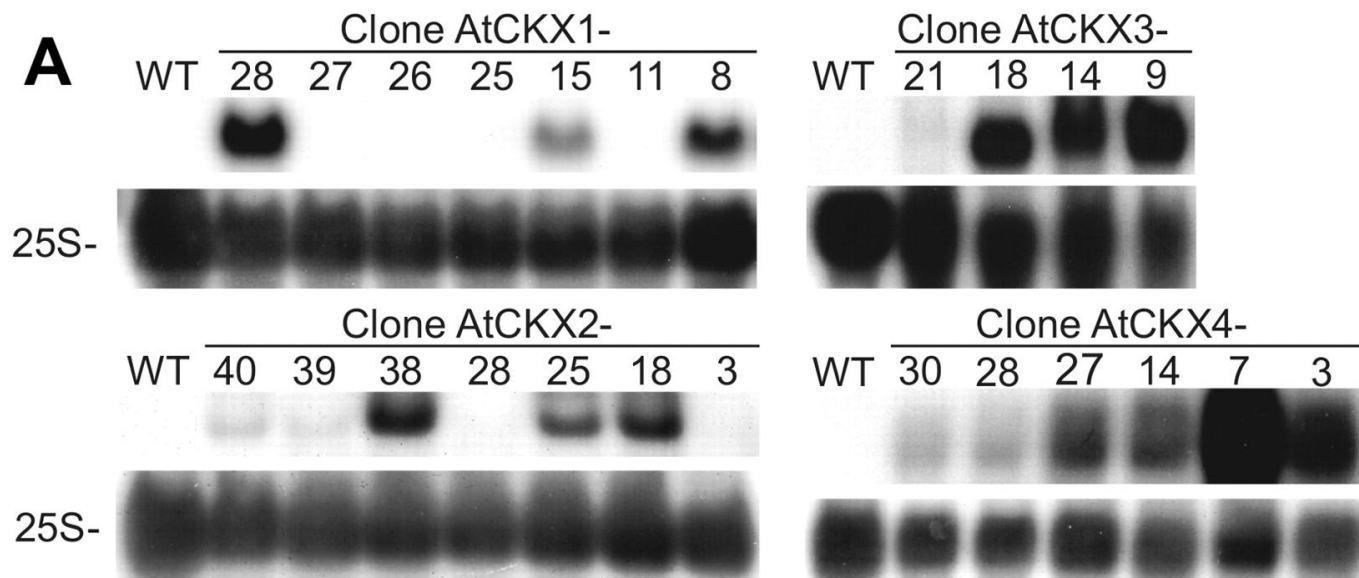
Auxin and cytokinin

roots

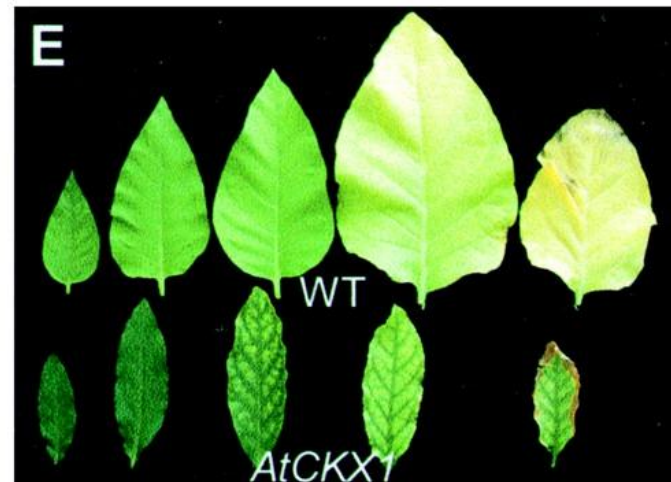
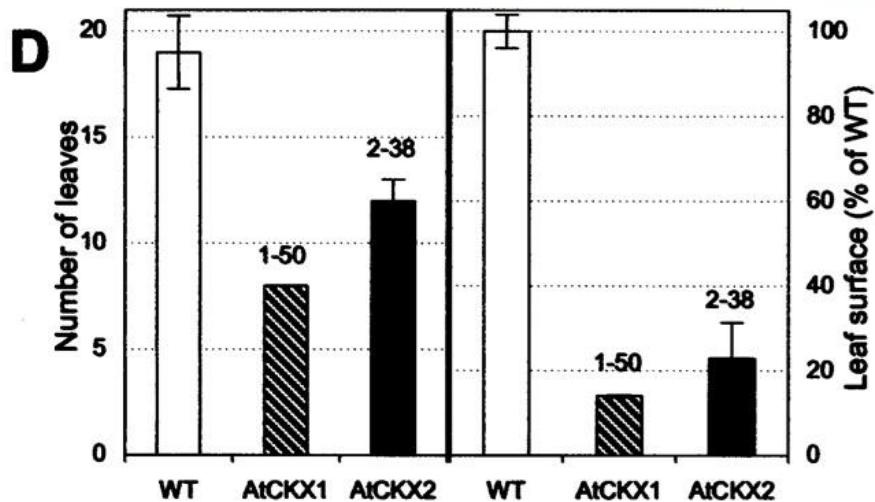
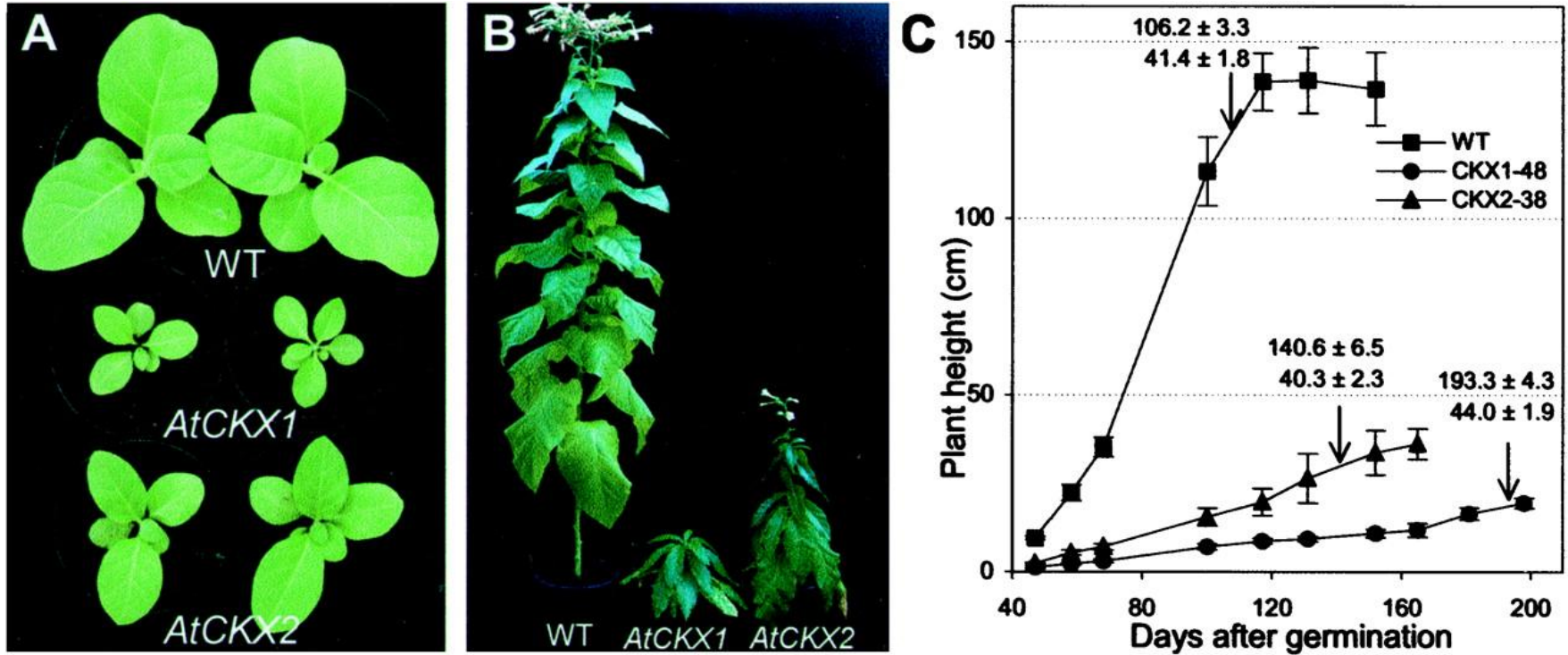
shoots



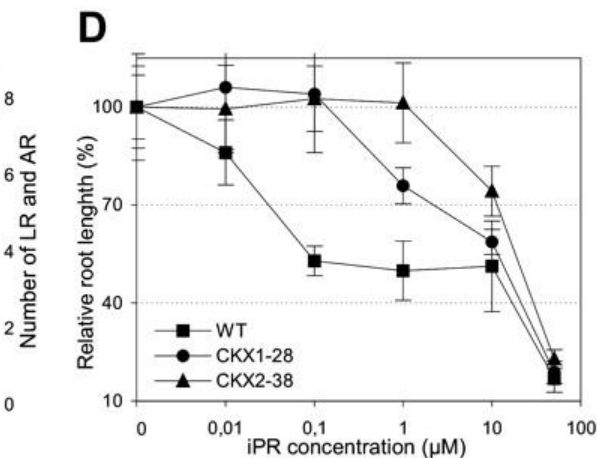
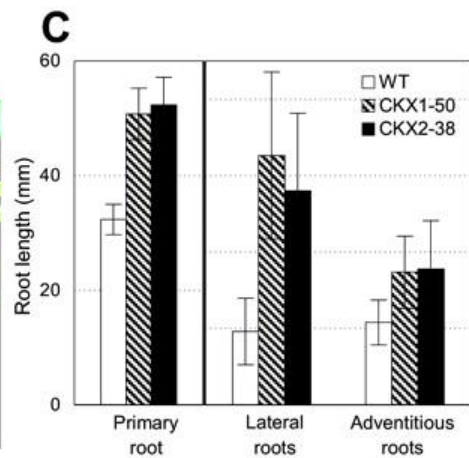
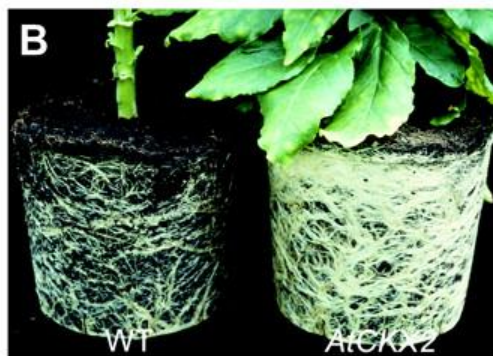
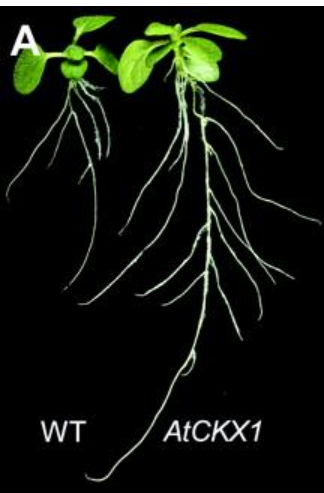
Isolation of CK-oxidase (AtCKX)



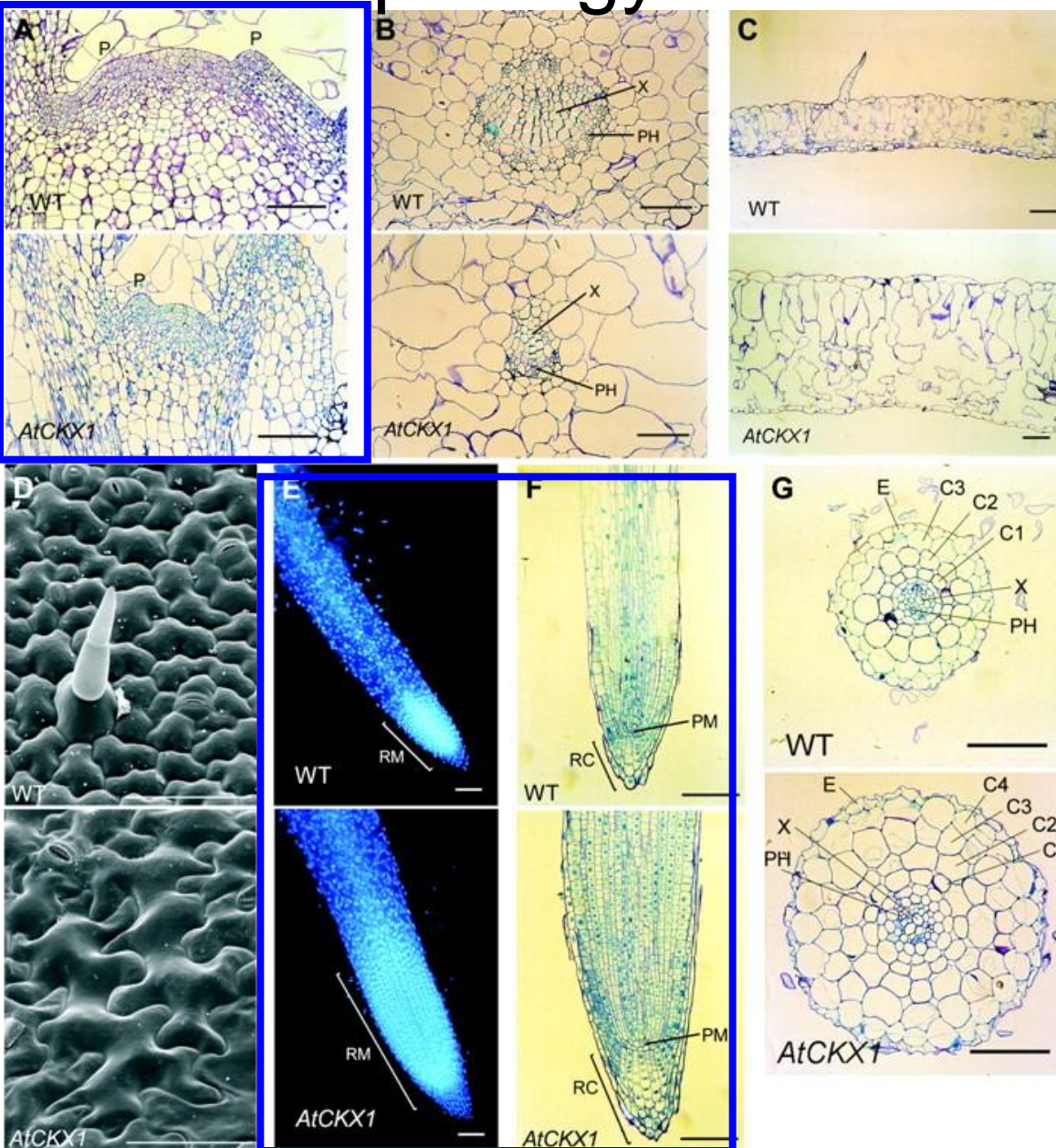
AtCKXs overexpression in tobacco



Effect of AtCKX on tobacco root

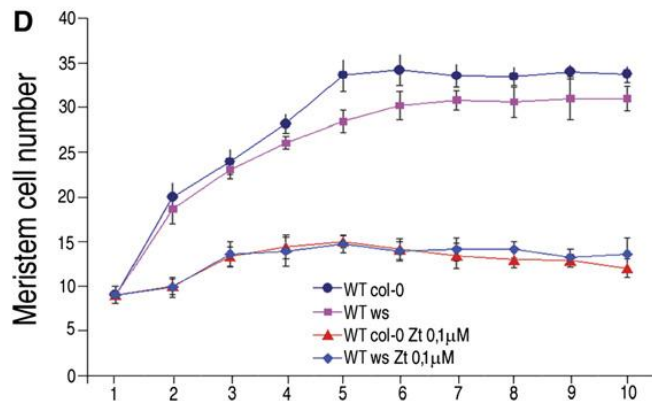
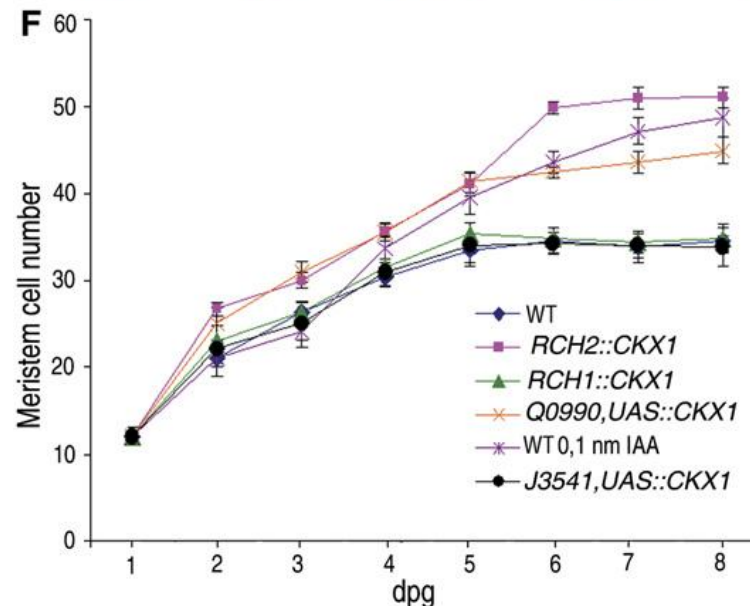
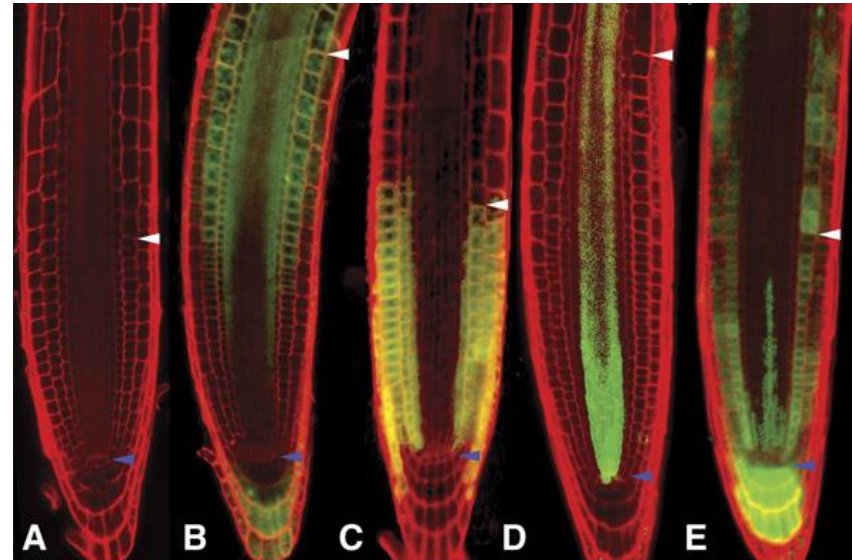
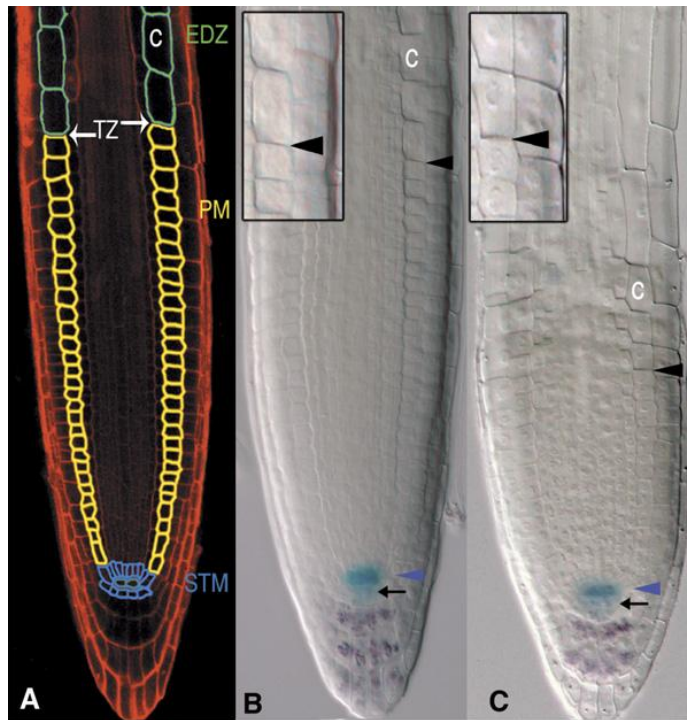


Morphology of AtCKX tobacco plants



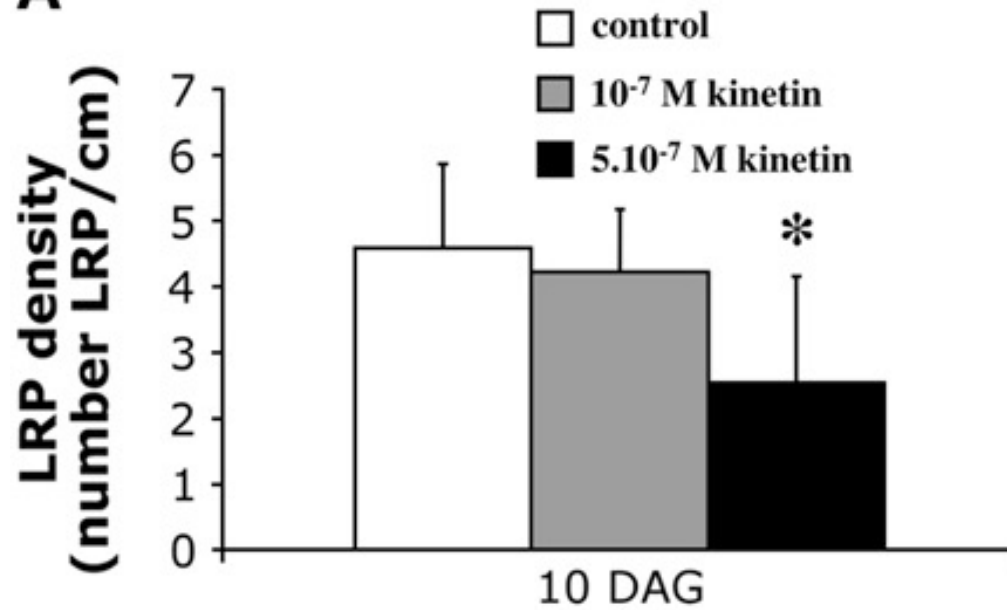
CK in shoot – positive regulator
 CK in root – negative regulator

Cytokinin – root meristem development

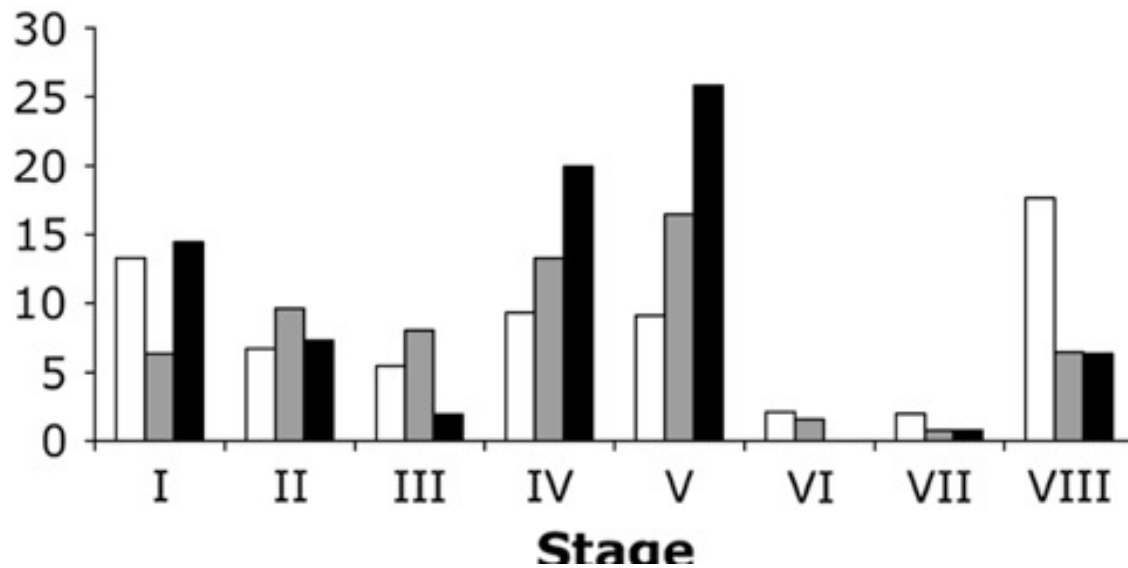


Cytokinin - lateral root organogenesis

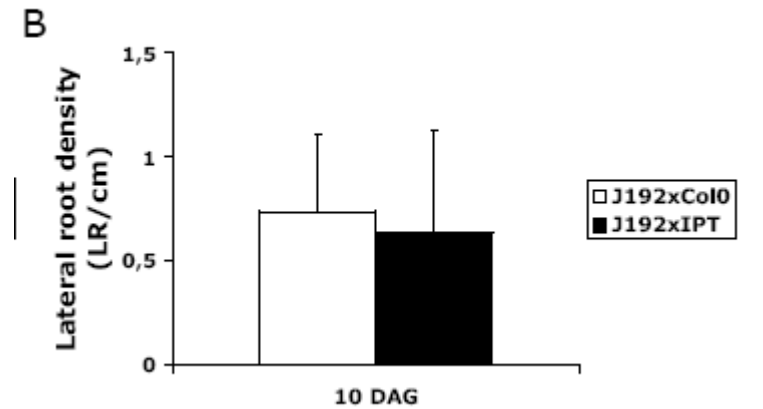
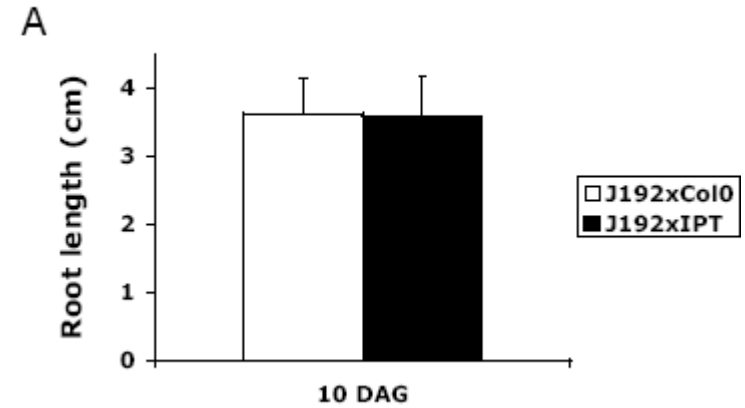
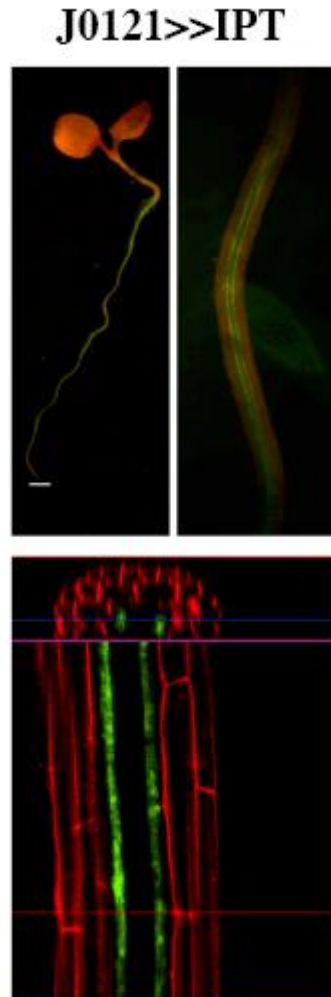
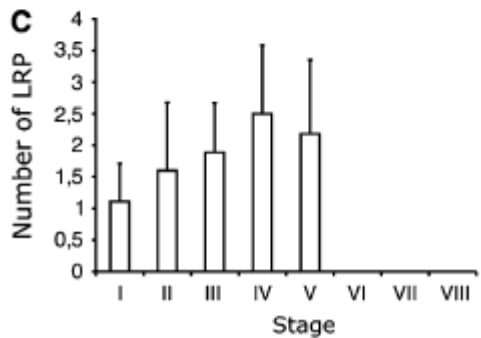
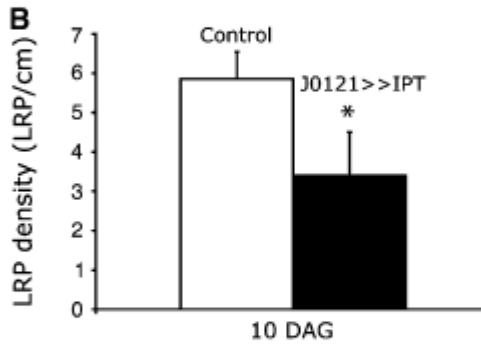
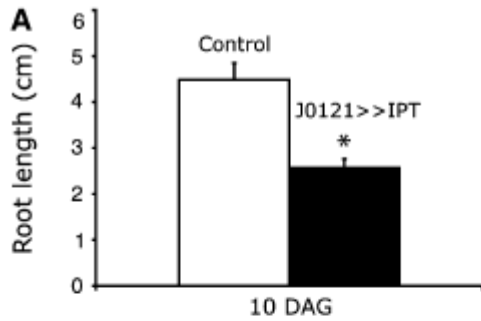
A



B



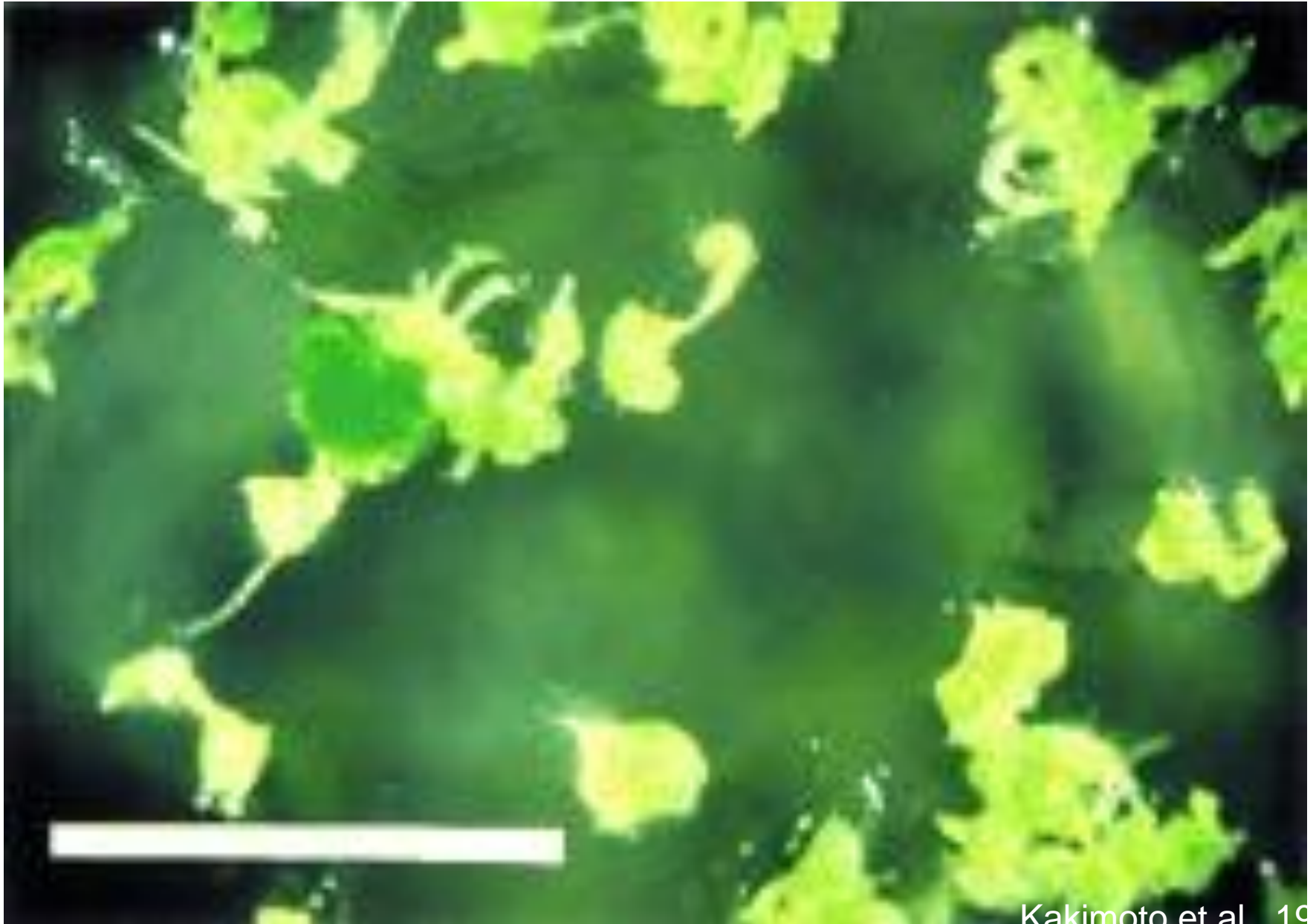
Cytokinin effect is stage specific



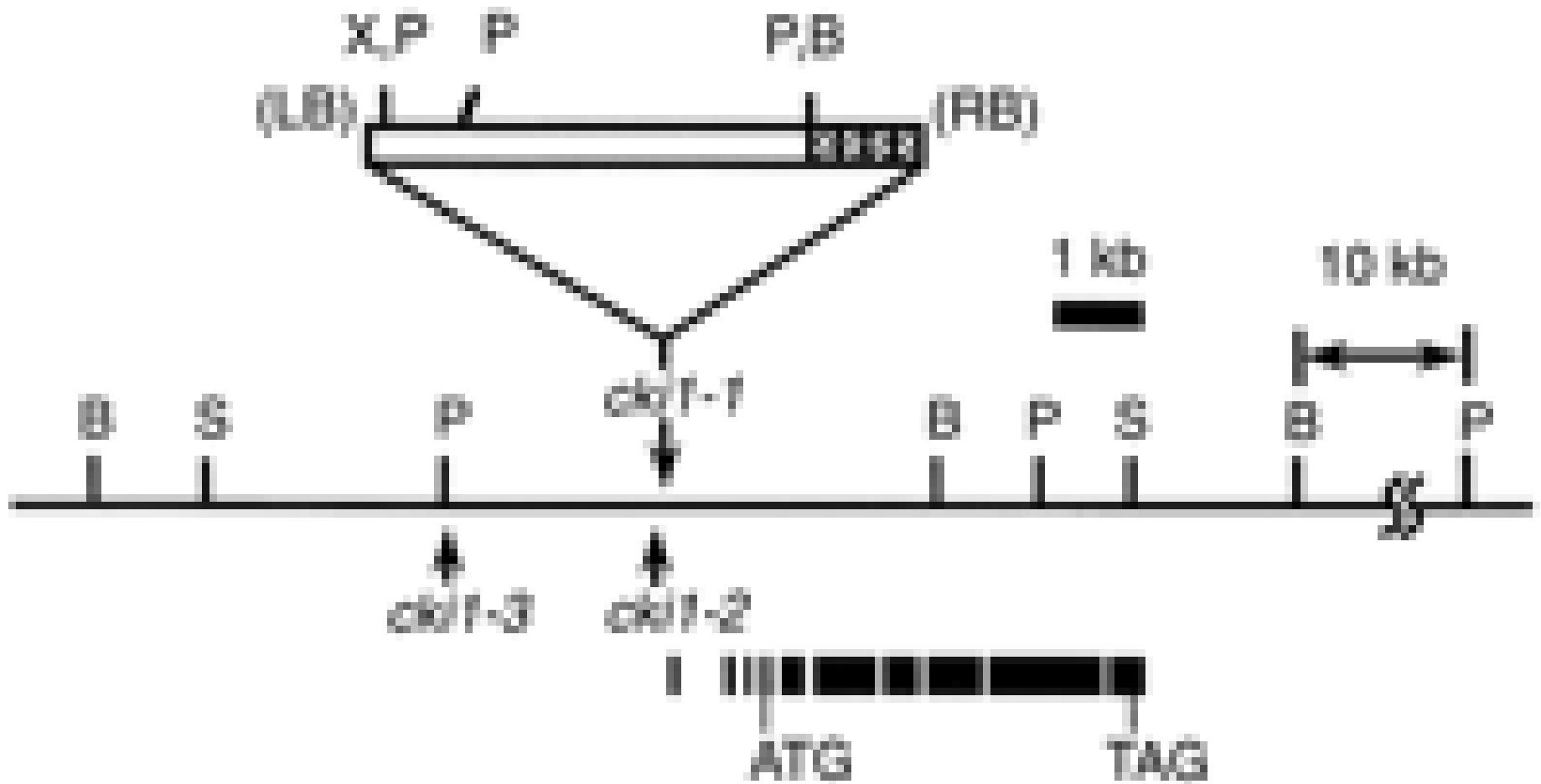
Cytokinin

–signal perception and transduction

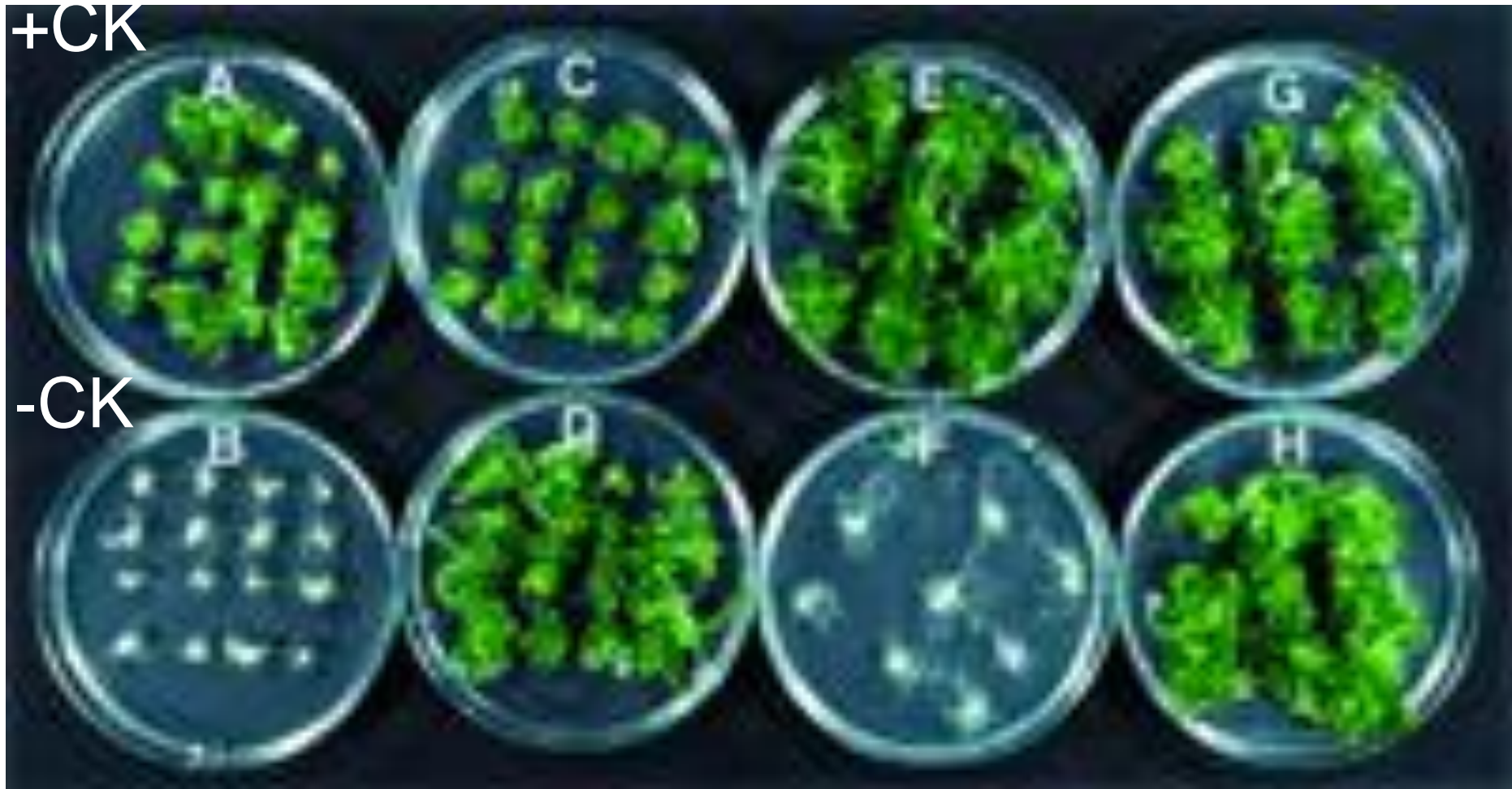
Isolation of CK independent (*cki1*) mutant

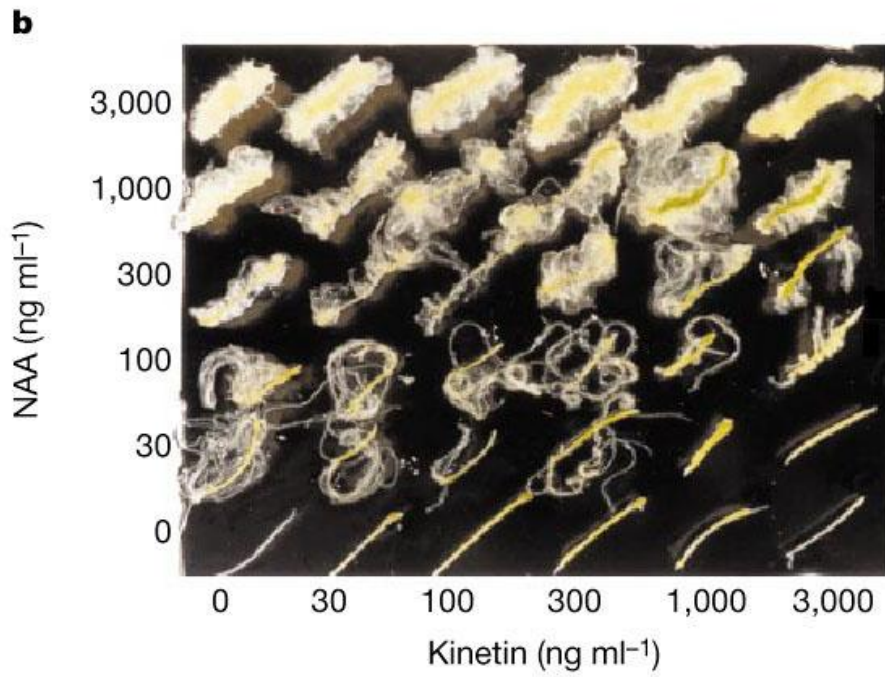
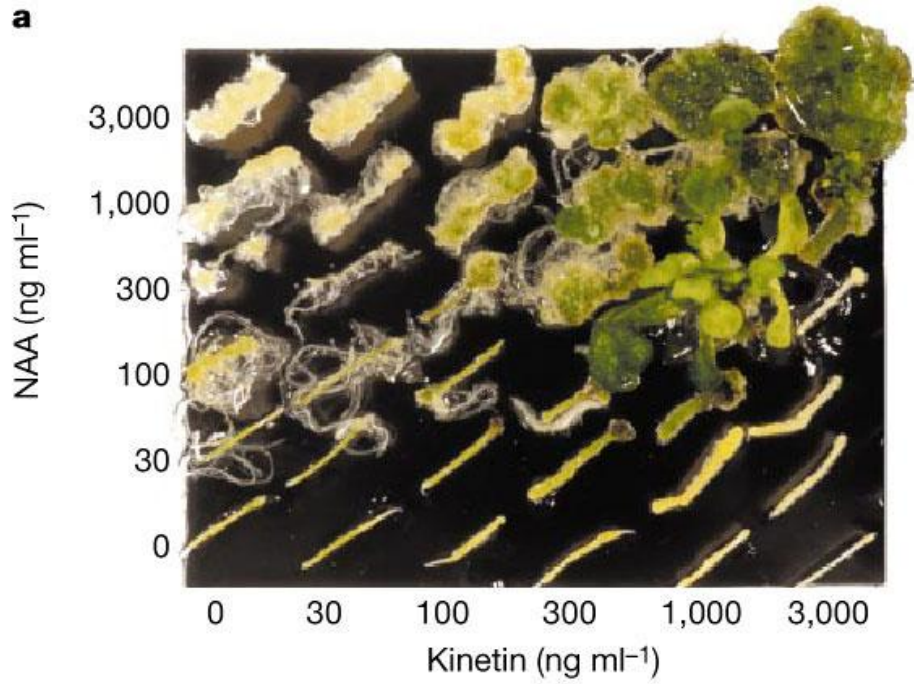


Identification of *CKI1* gene



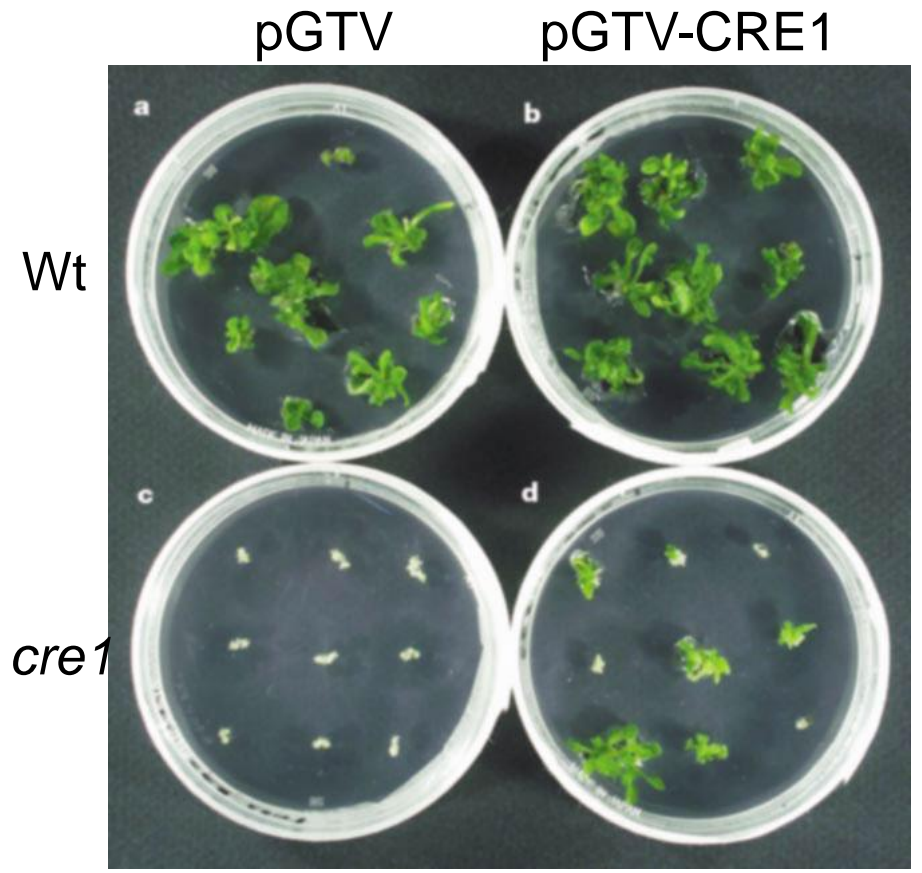
Verification - *35S::CKI1* transgene





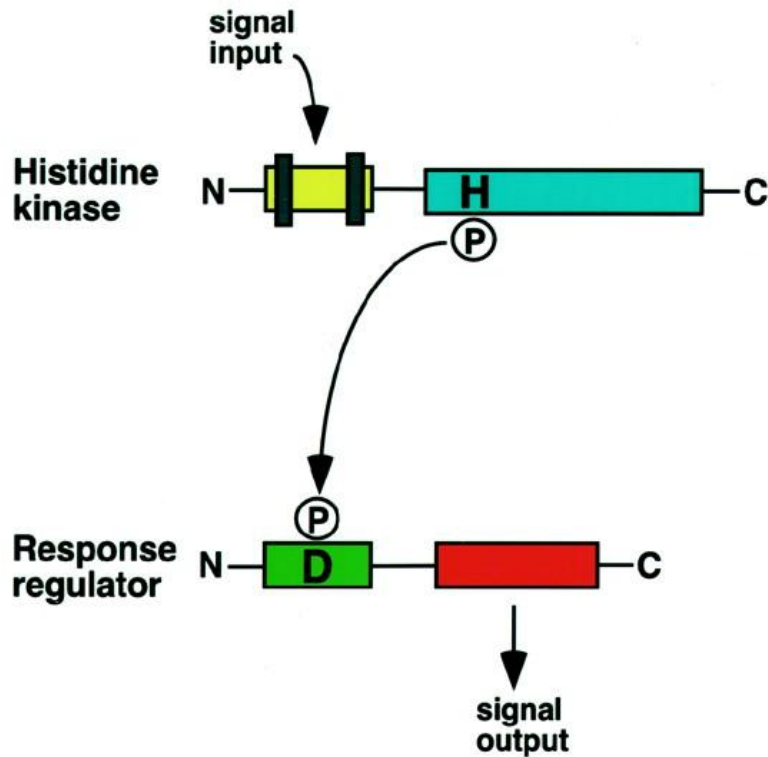
Next strike

- CK response mutant (*cre1*)

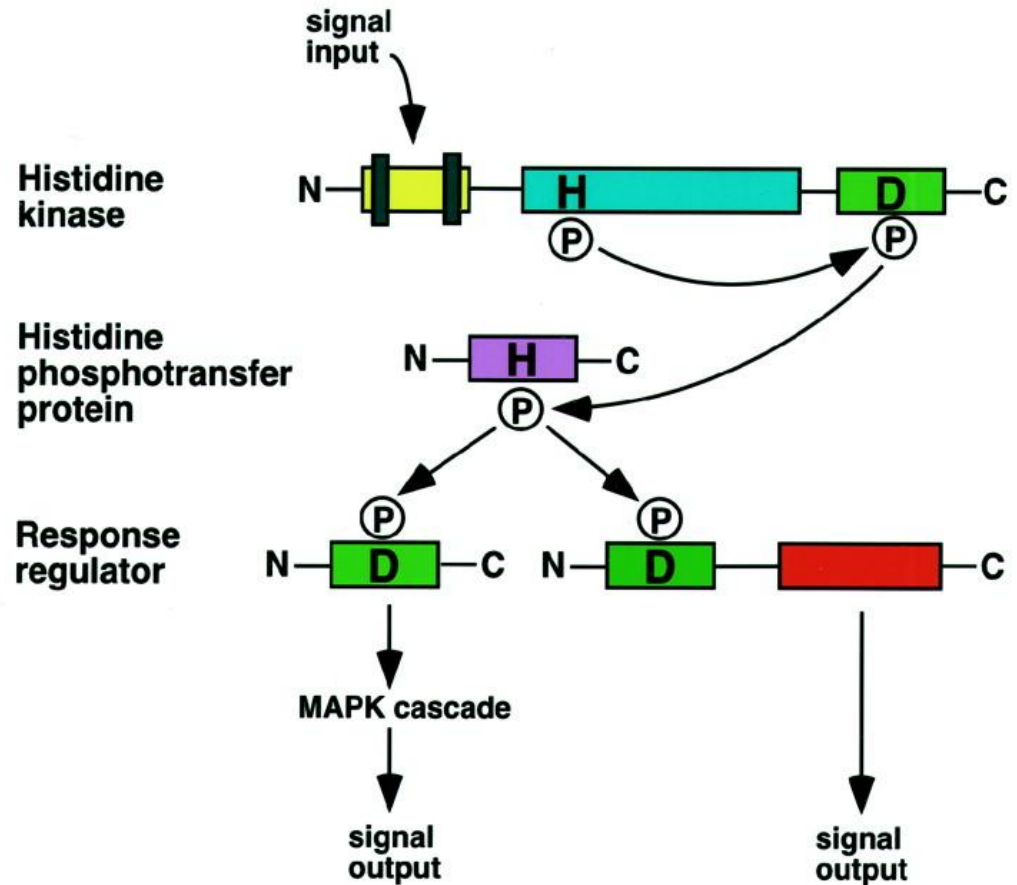


His kinase transduction pathway

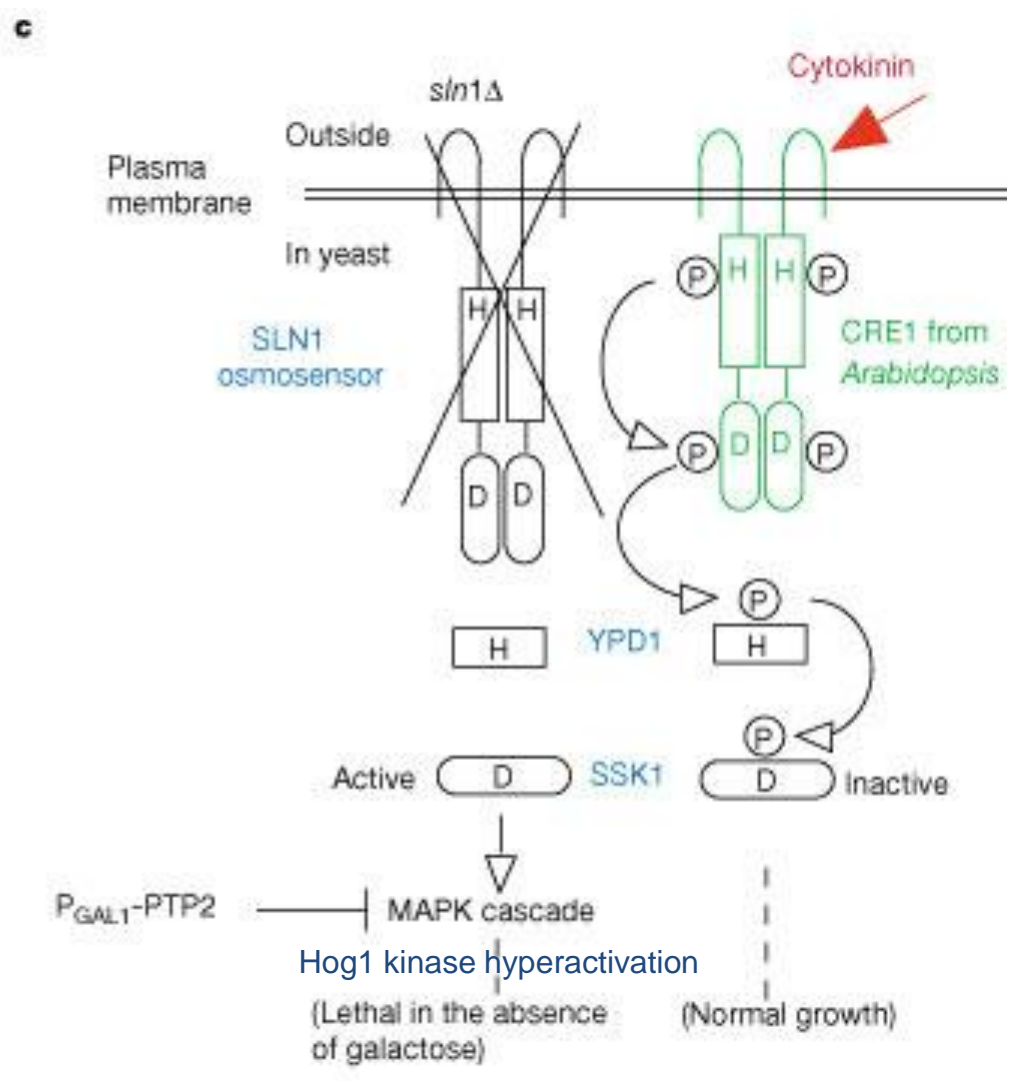
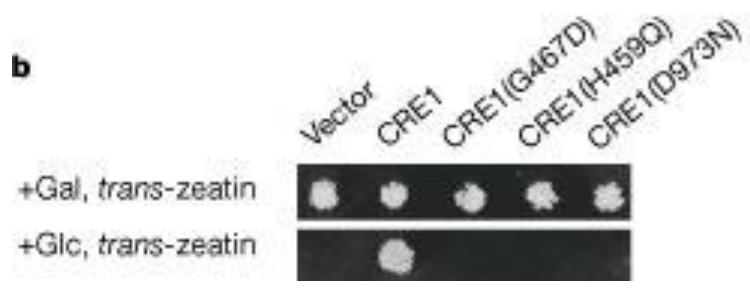
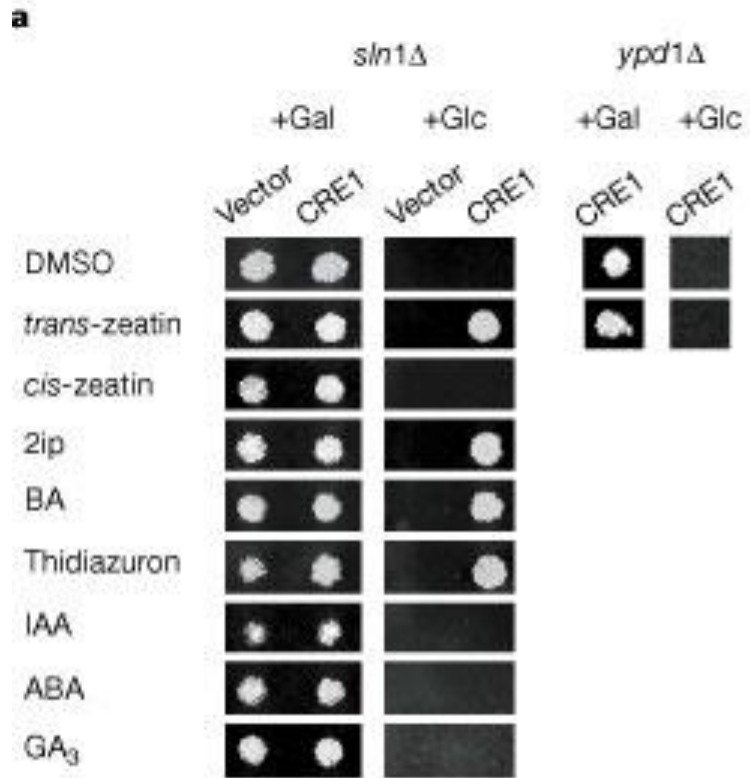
A



B



Piece of genius - complementation



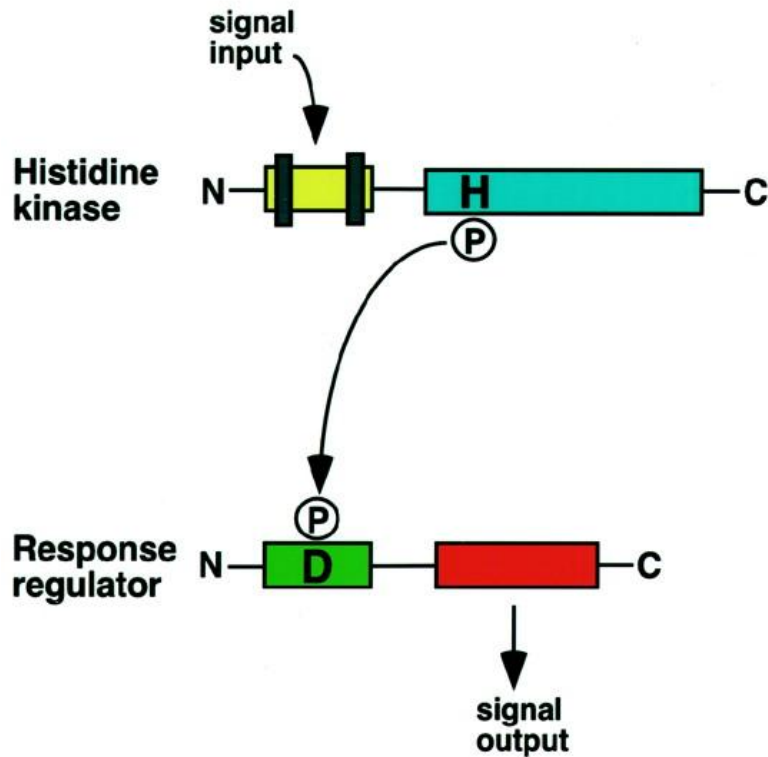
Cytokinin receptors – what else?

3 CRE1 homologous proteins (AHKs)
multiple mutant phenotypes – additive
(not lethal)

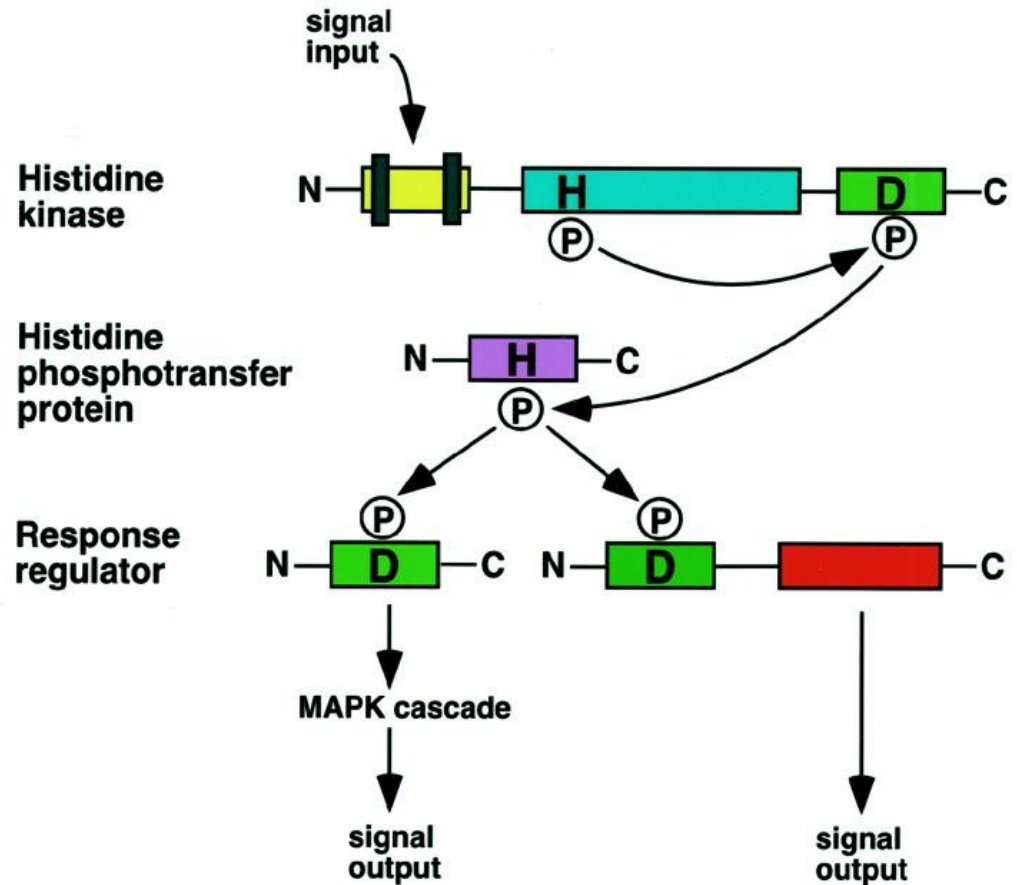
What does CKI1?

His kinase transduction pathway

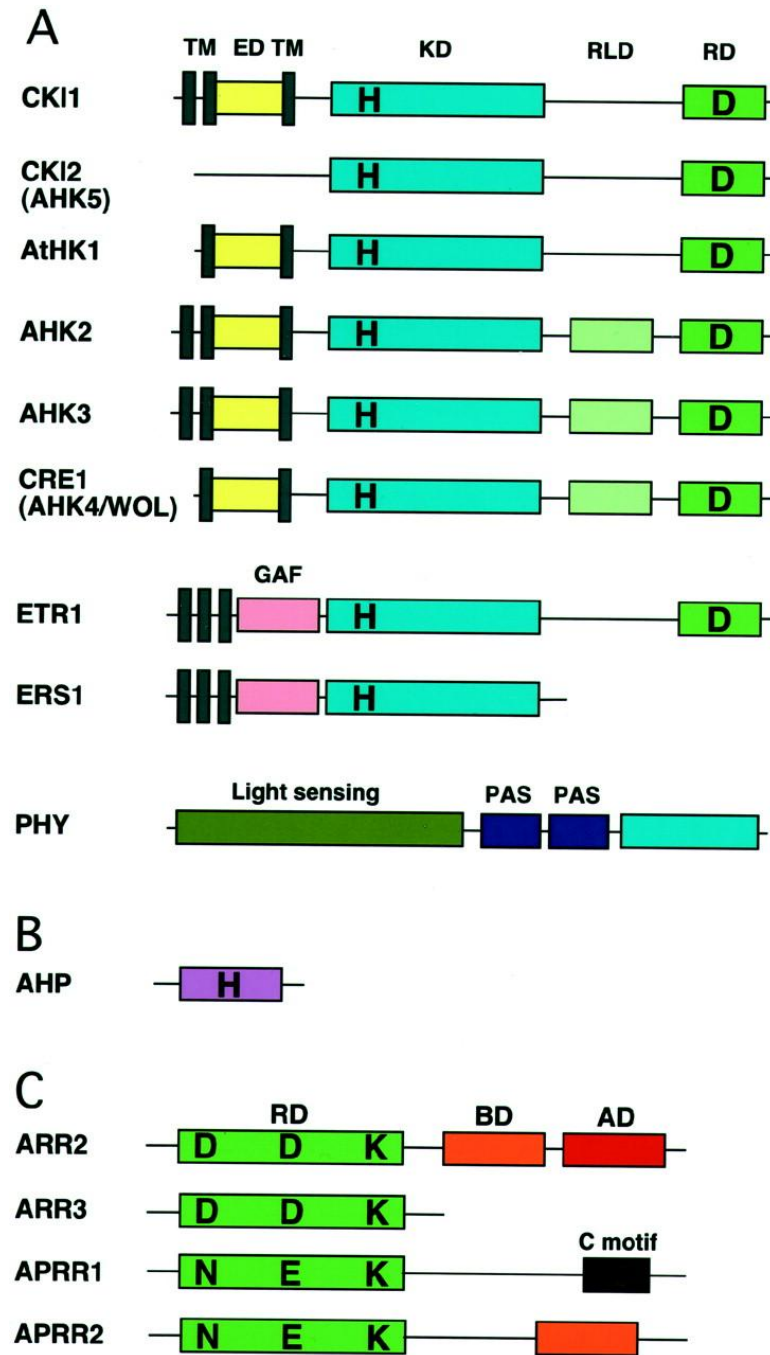
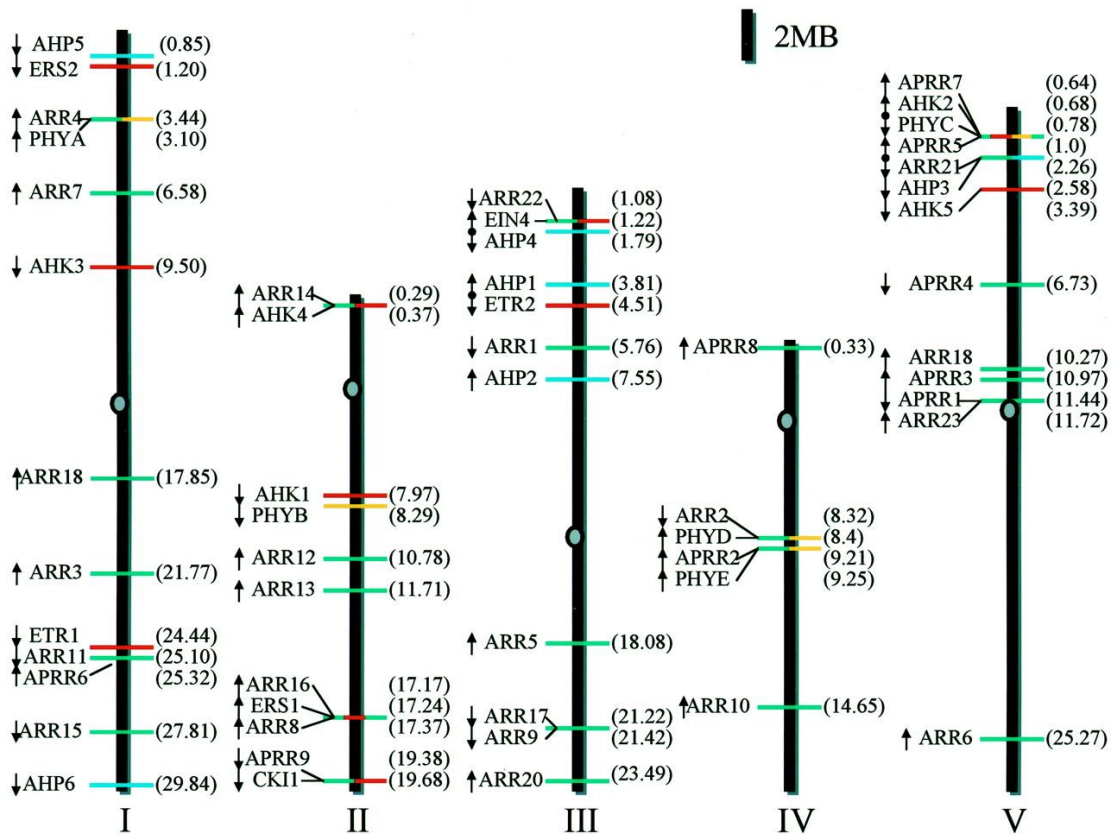
A



B

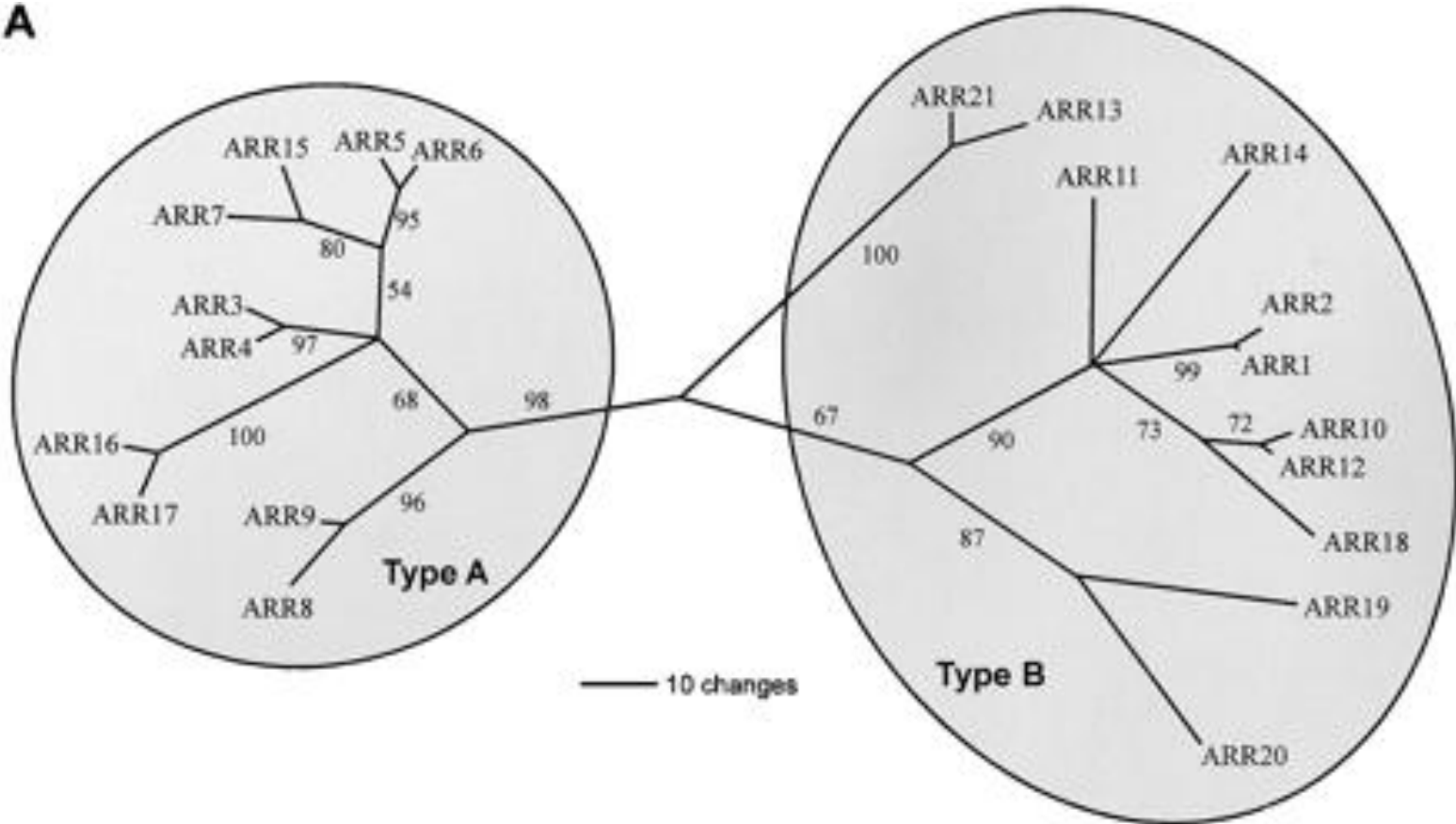


His kinase pathway components in Arabidopsis

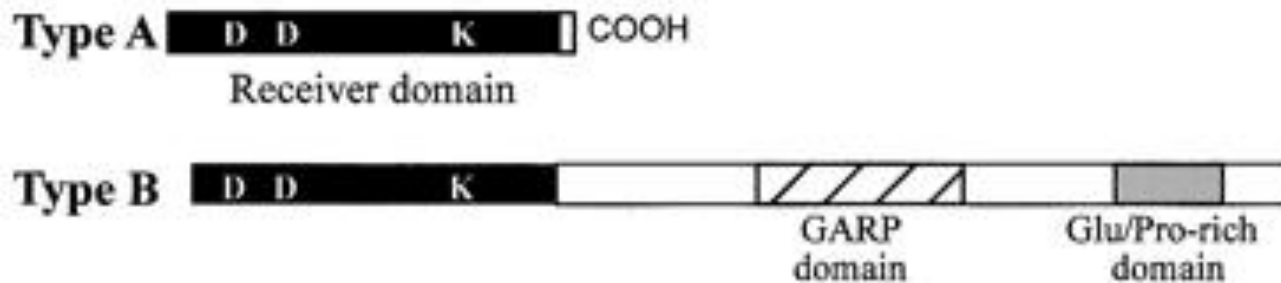


Response Regulators in *Arabidopsis*

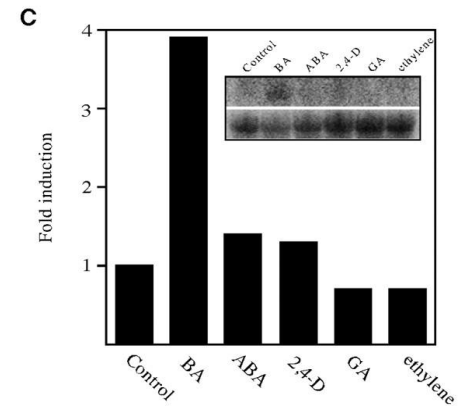
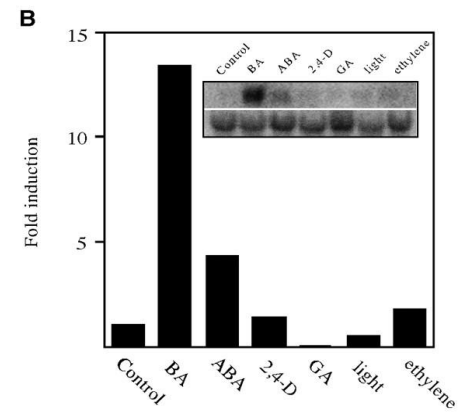
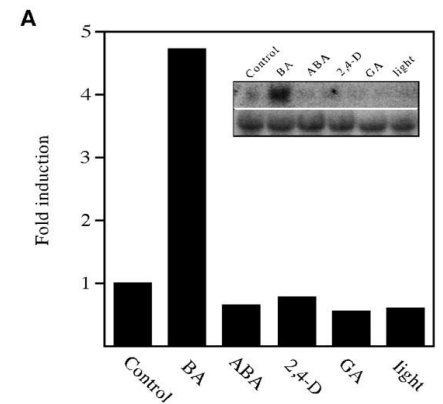
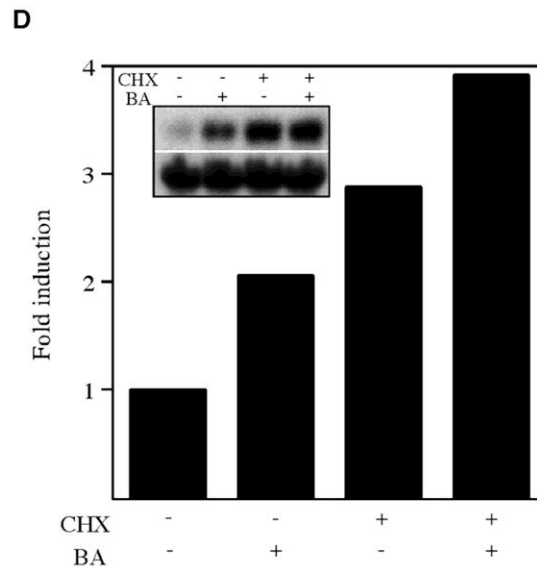
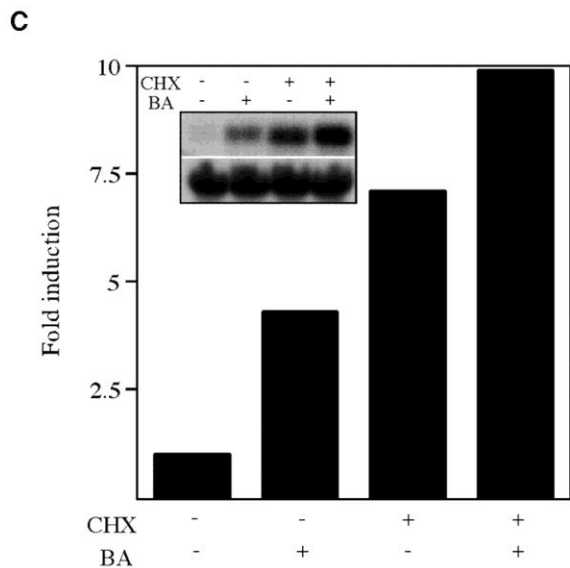
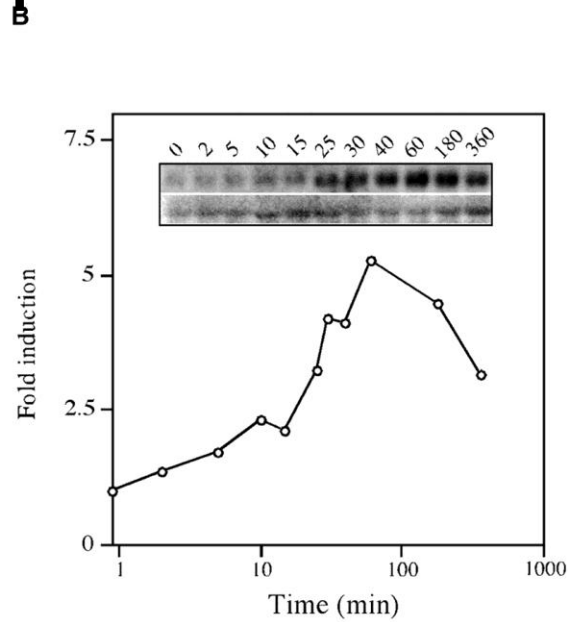
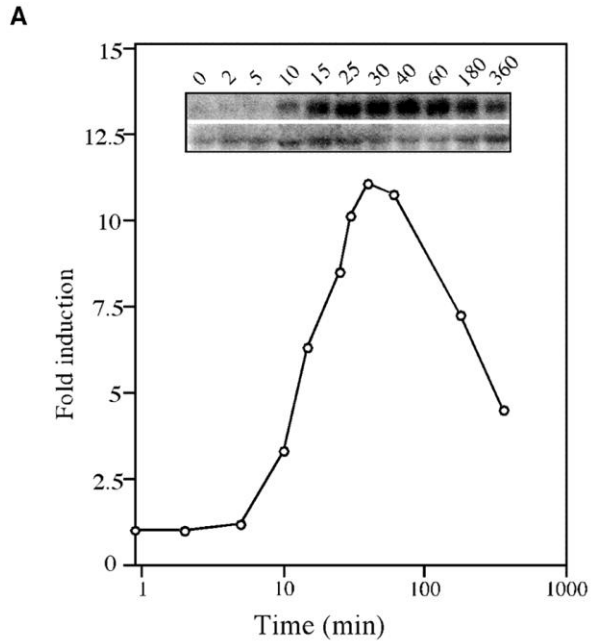
A



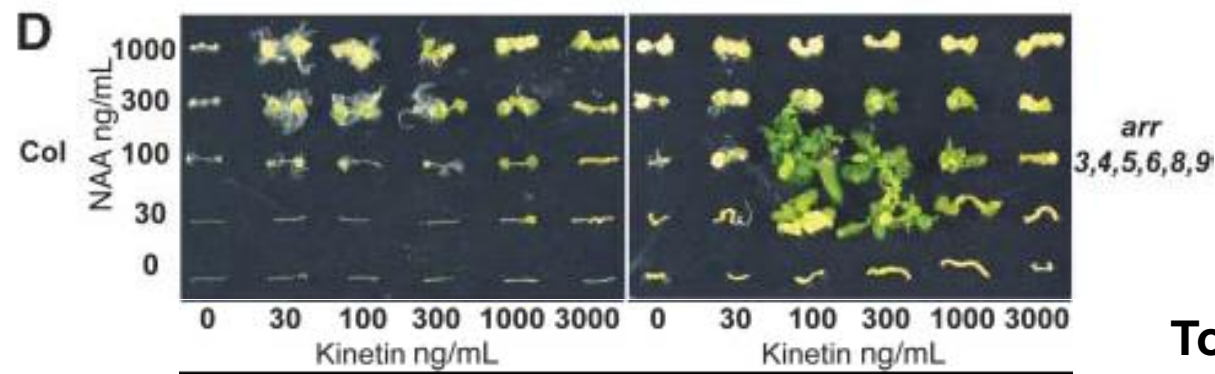
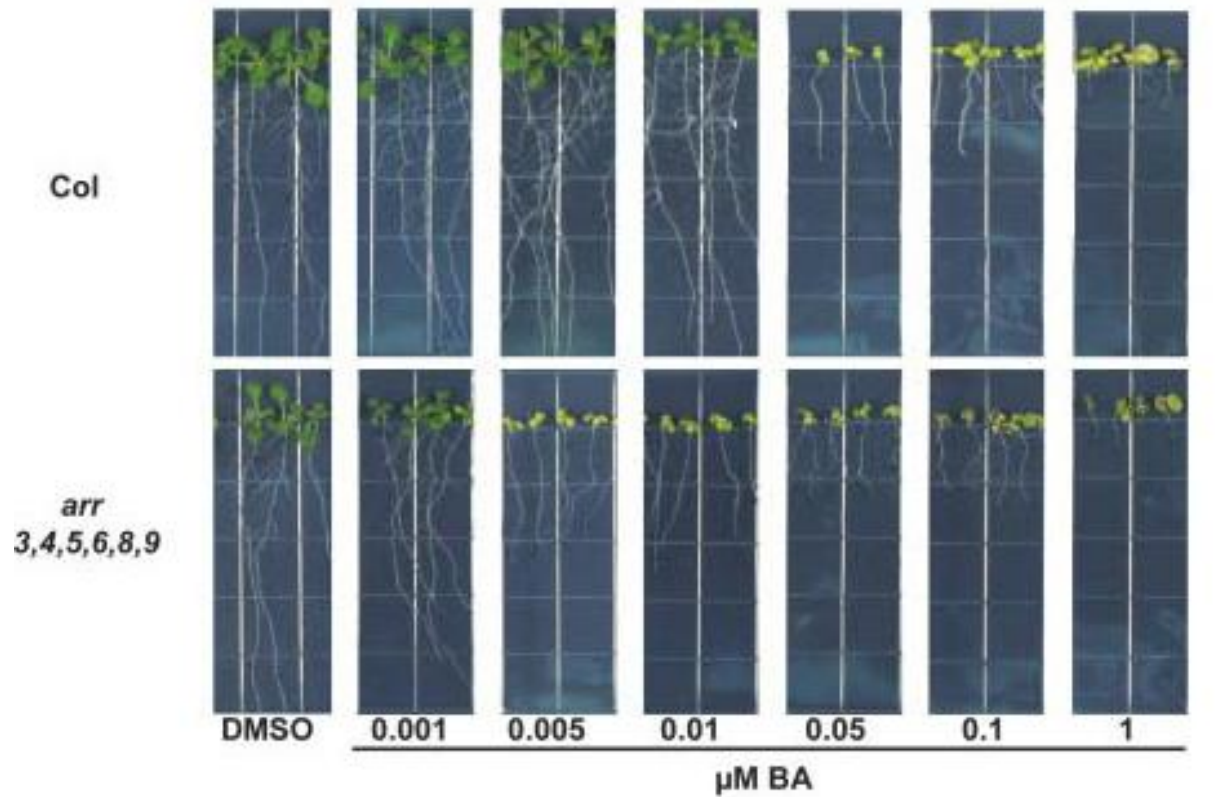
B



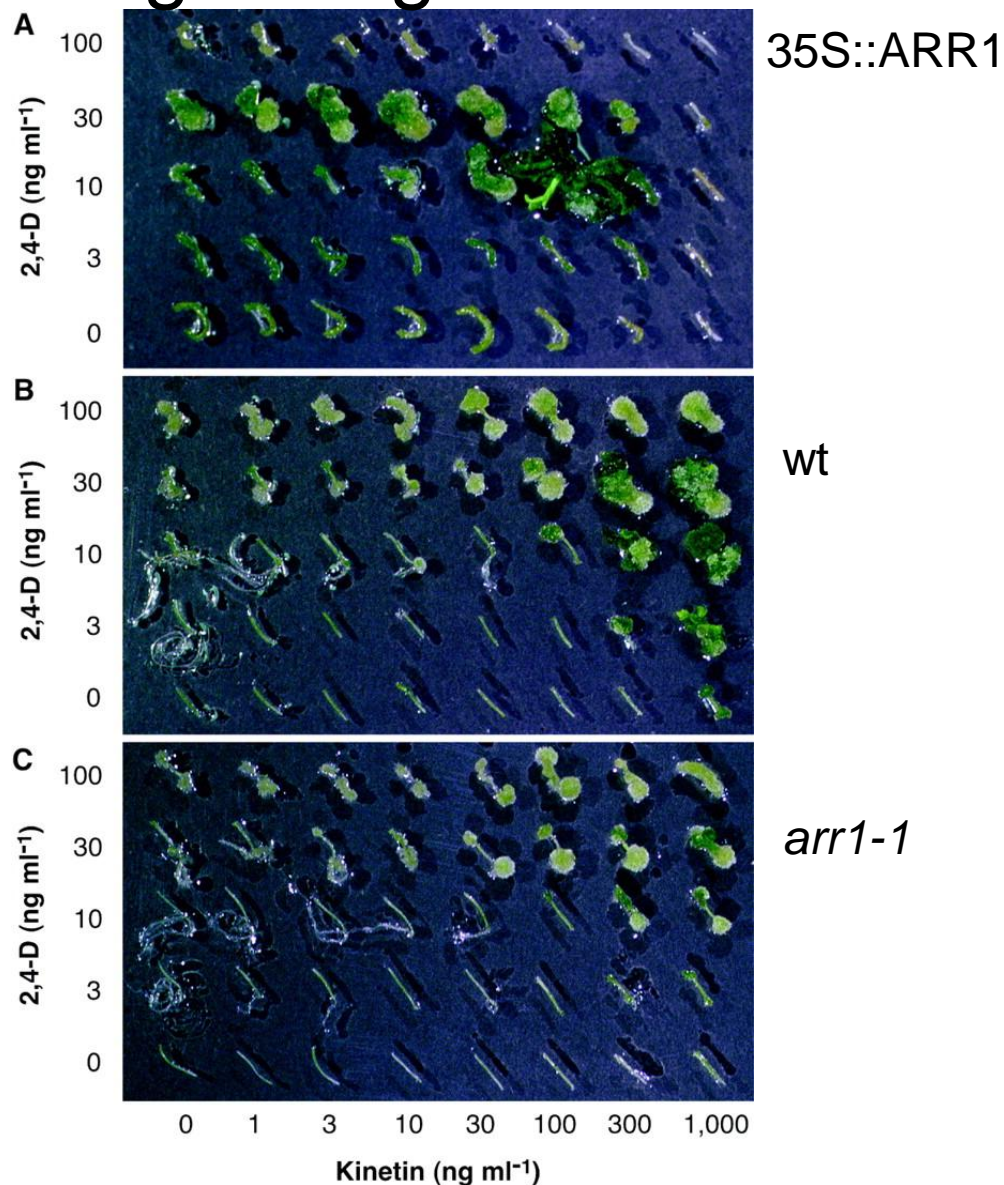
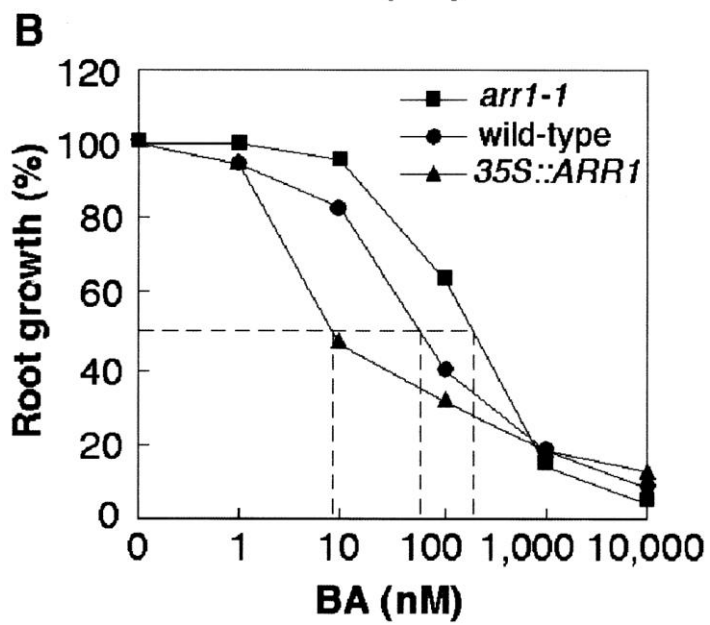
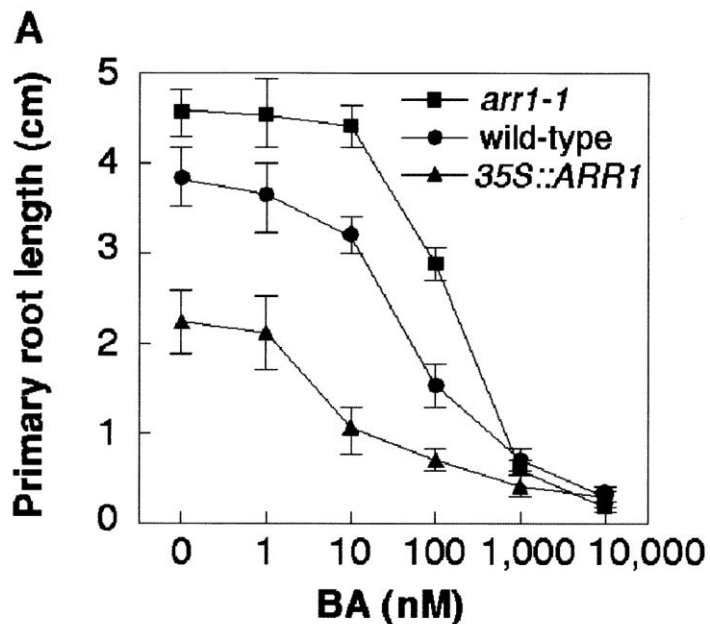
CK responsive genes – *ARR* type A



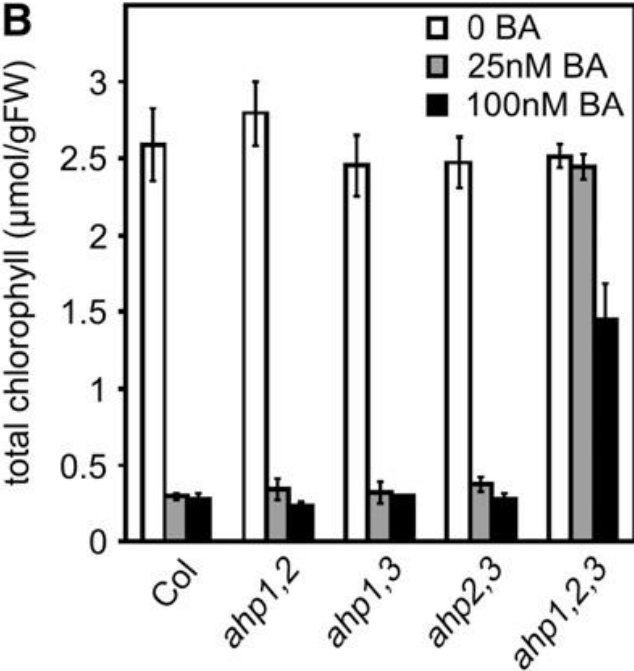
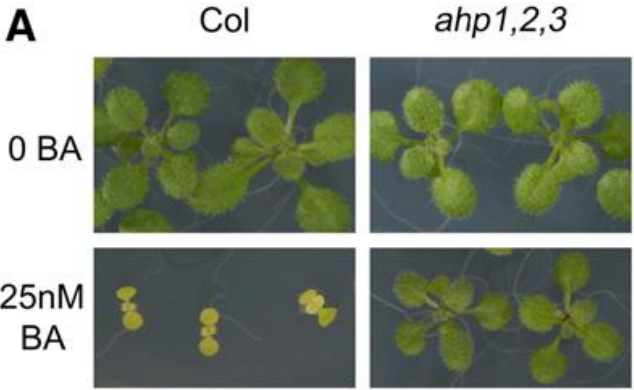
Response regulator ARR type A- negative regulators of cytokinin signalling



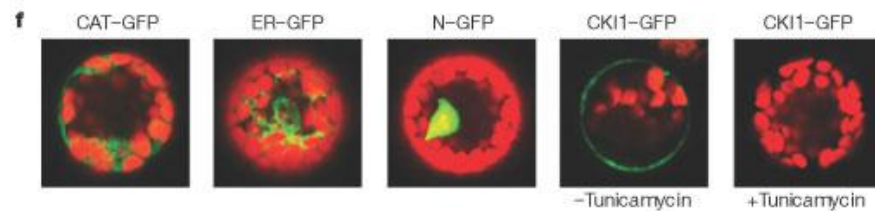
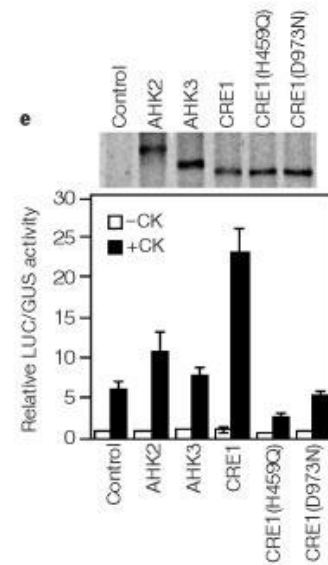
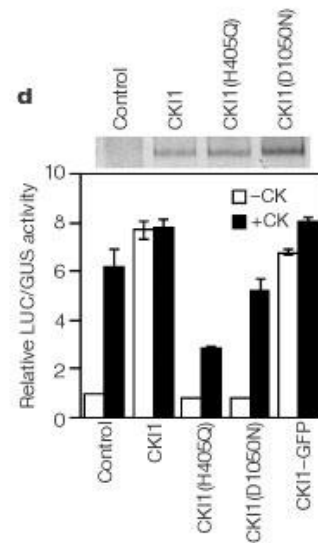
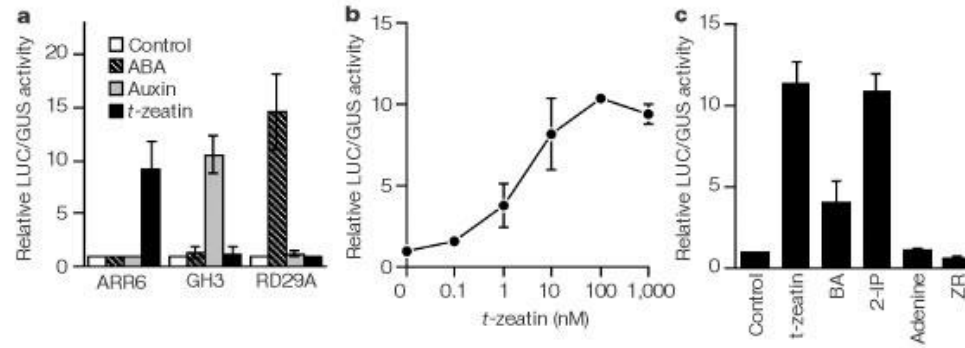
Phenotypes of *arr* type B positive regulator of CK signalling



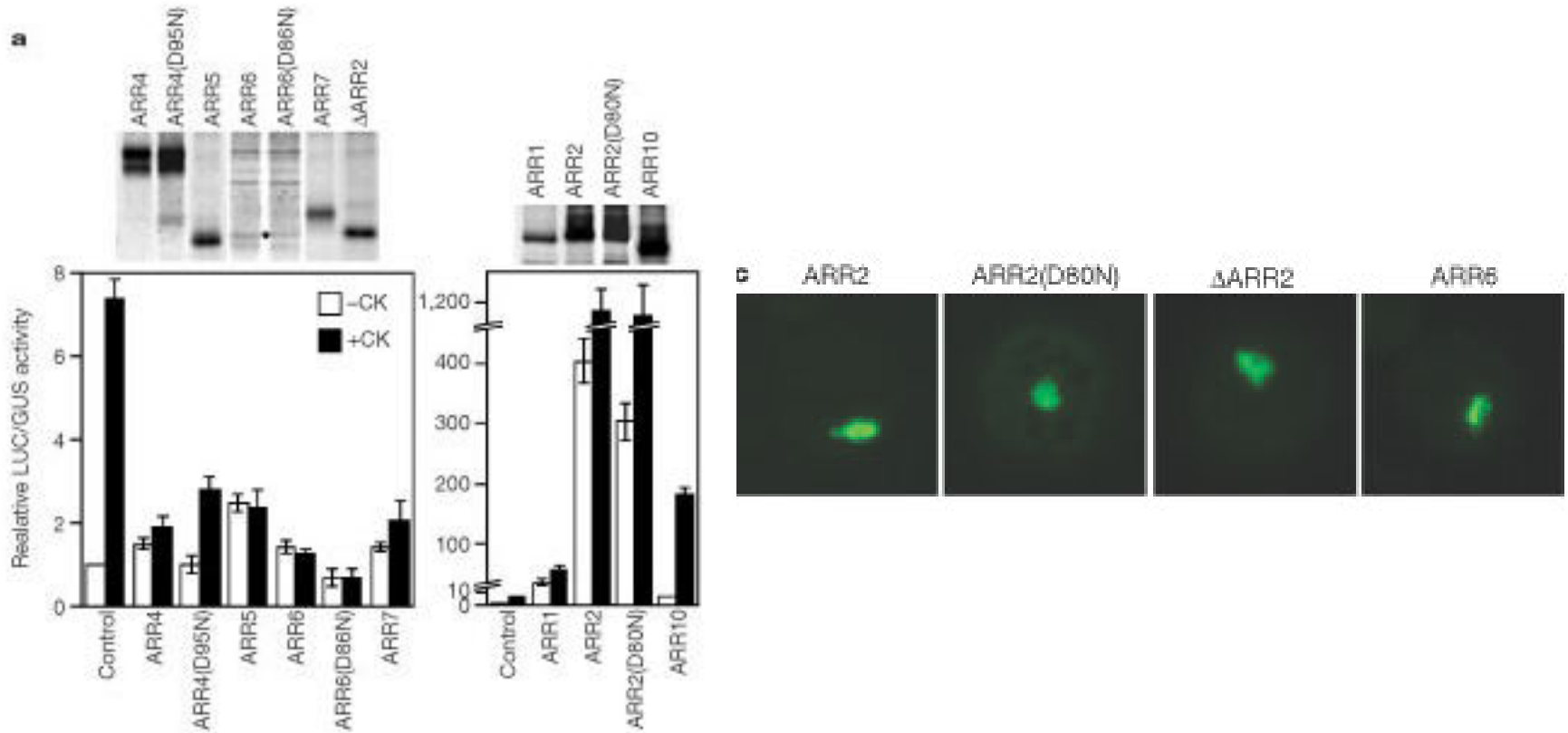
AHPs mediate transfer of cytokinin signal between cytoplasm and nucleus



Games with protoplasts

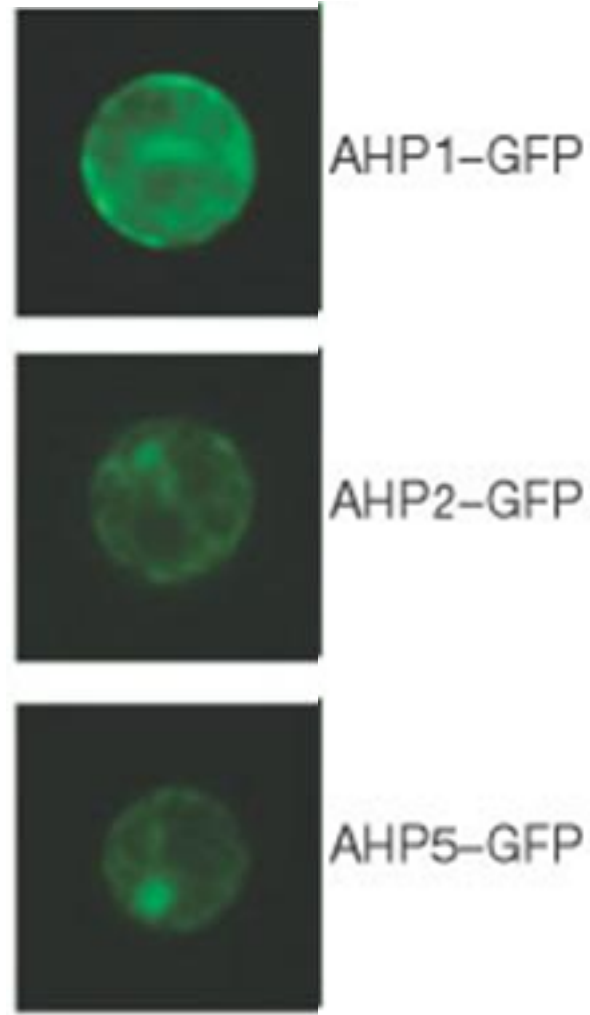
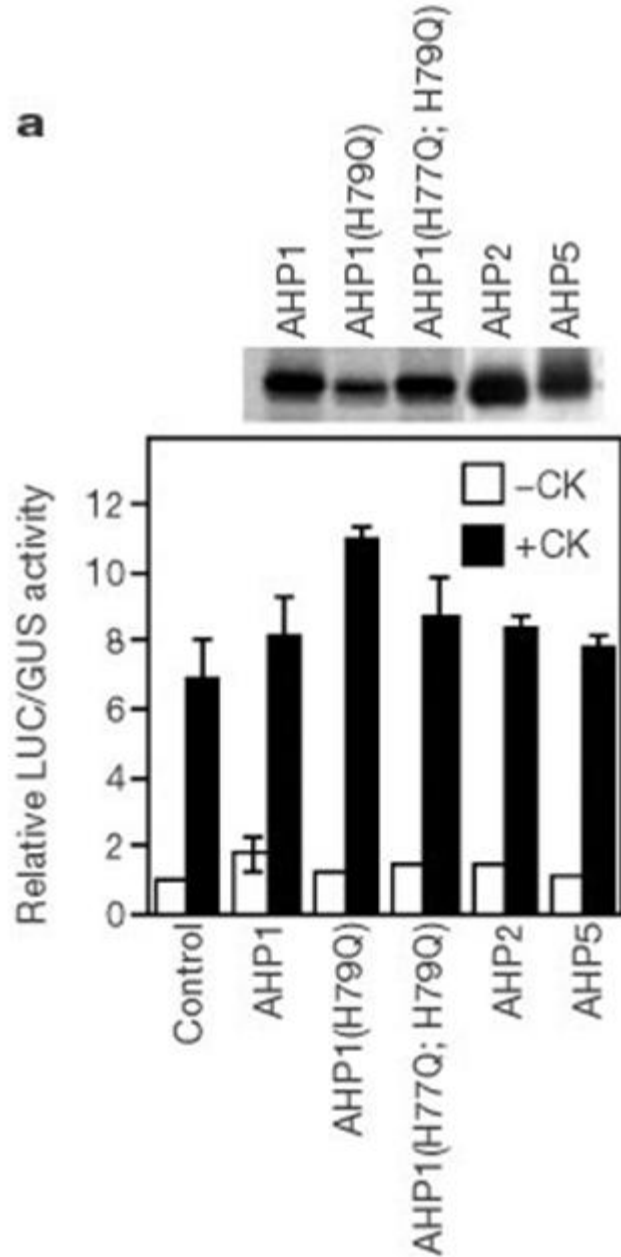


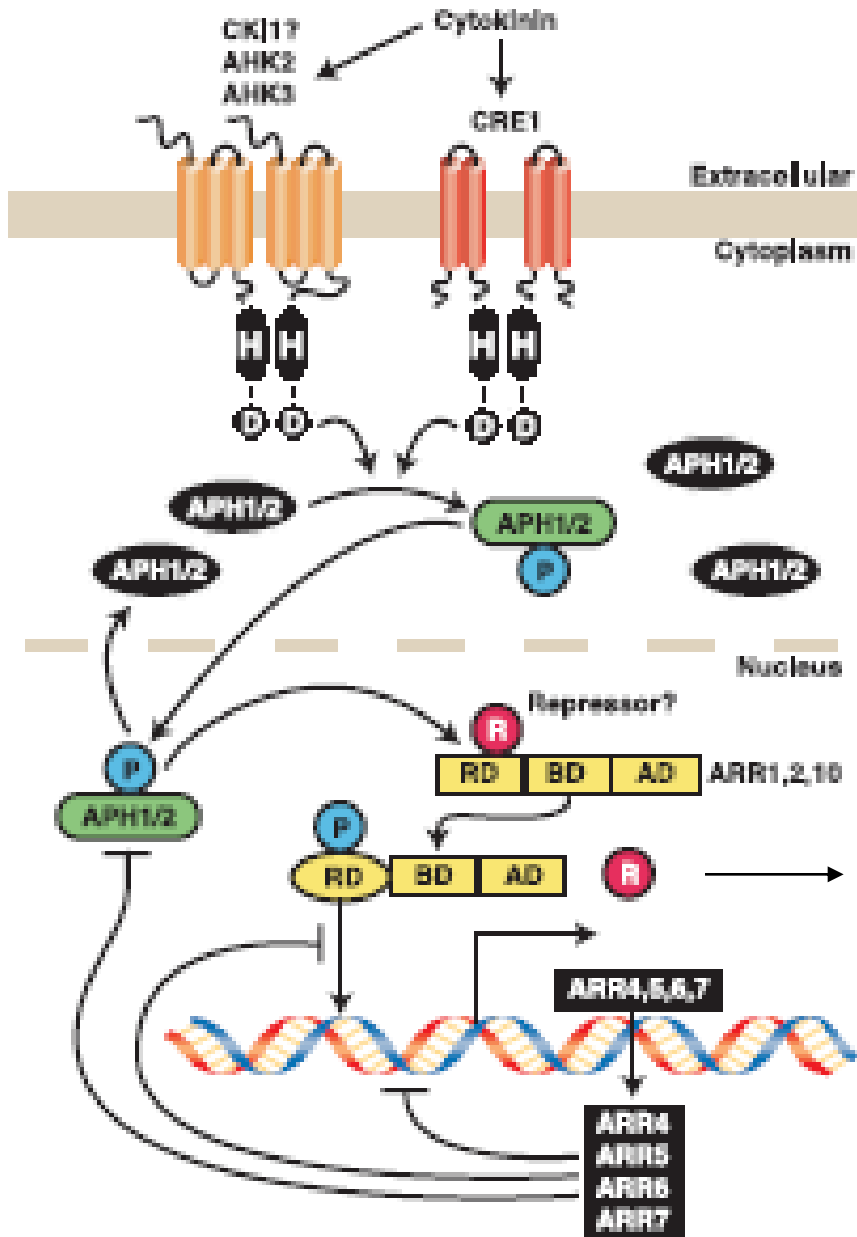
Opposite effects of two classes of ARR2s on CK signalling



AHPs – signal to nucleus

a



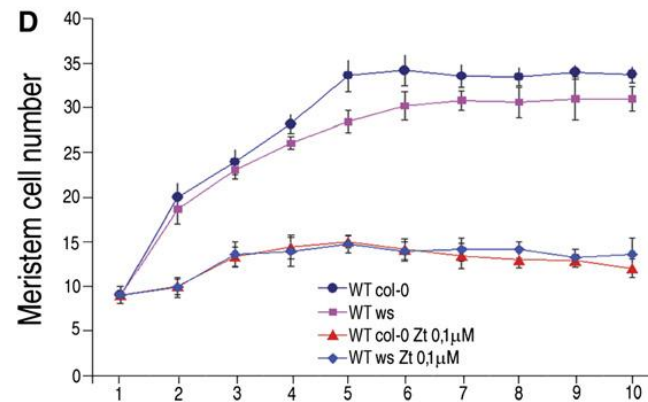
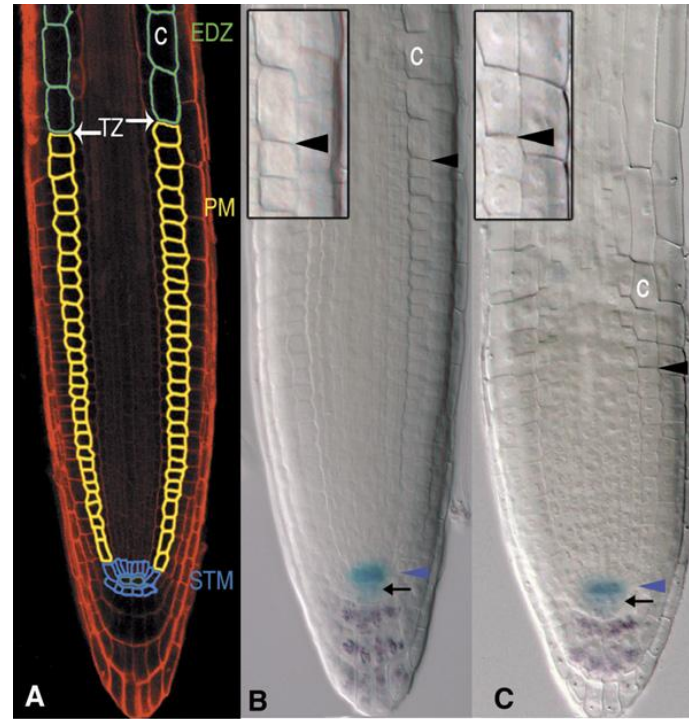


Hextuple of type A ARRs confirms role as negative regulators

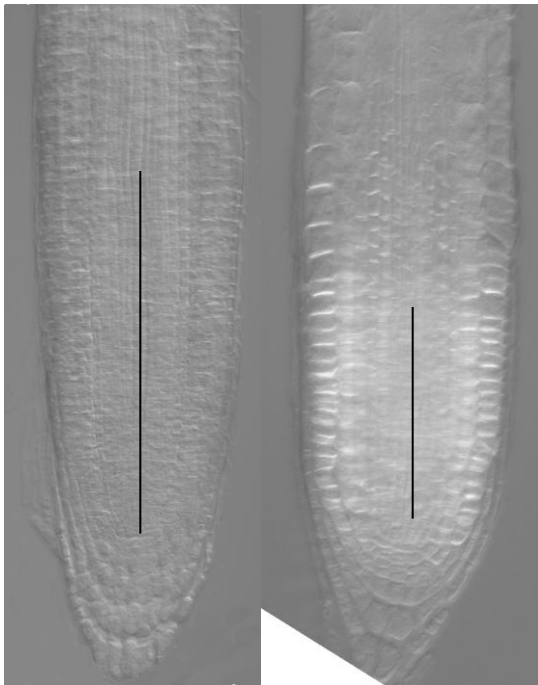
e.g. Root elongation assay

- Transcription
- Cell division
- Shoot formation
- Delayed senescence
- Vascular development

Cytokinin – root meristem development

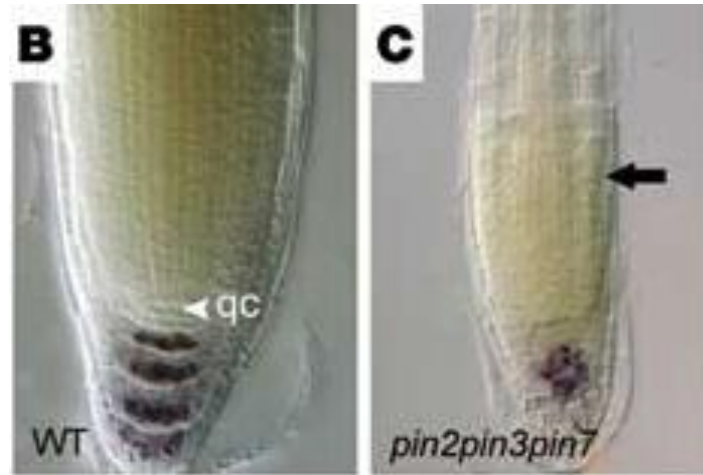


Auxin related mutants with short meristem



MS

cytokinin

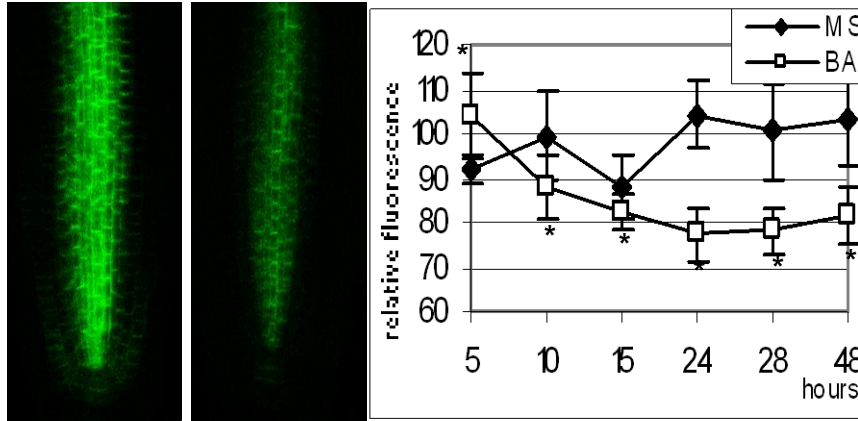


Blilou et al.,2005

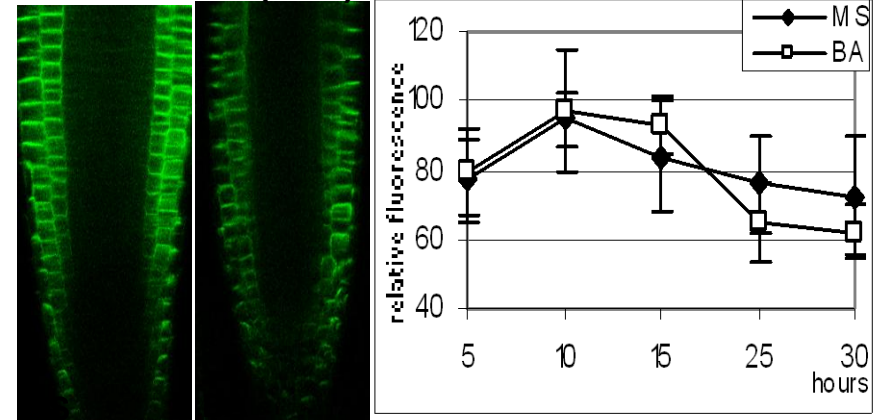
Auxin transport mutants

Cytokinin modulates auxin transport

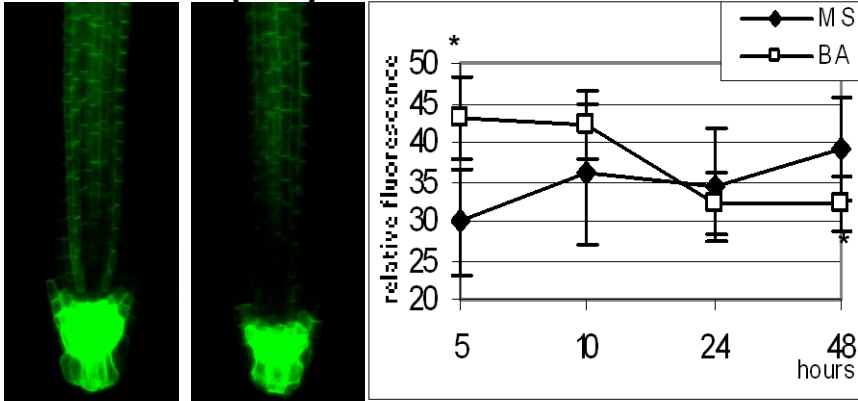
PIN1:GFP (24 h)



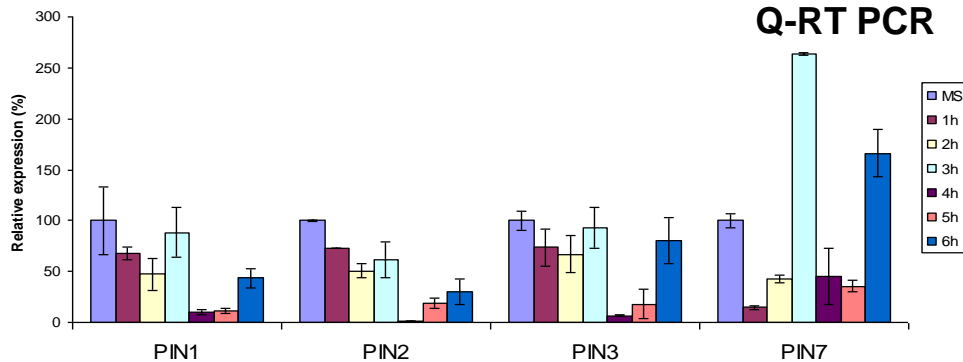
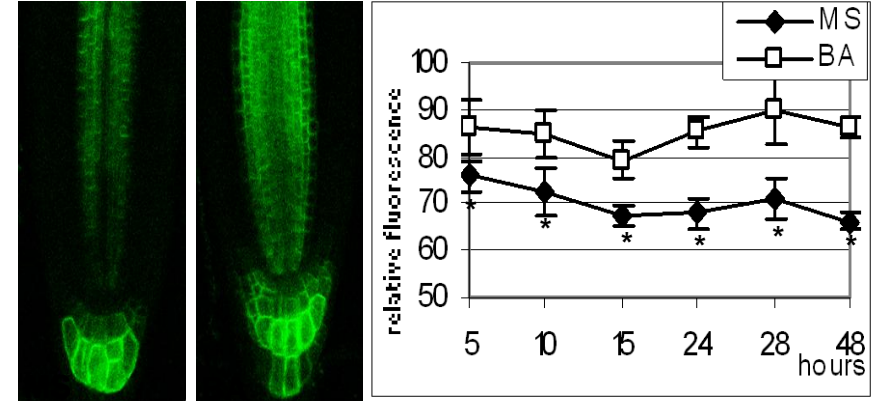
PIN2:GFP (48 h)



PIN3:GFP (24h)

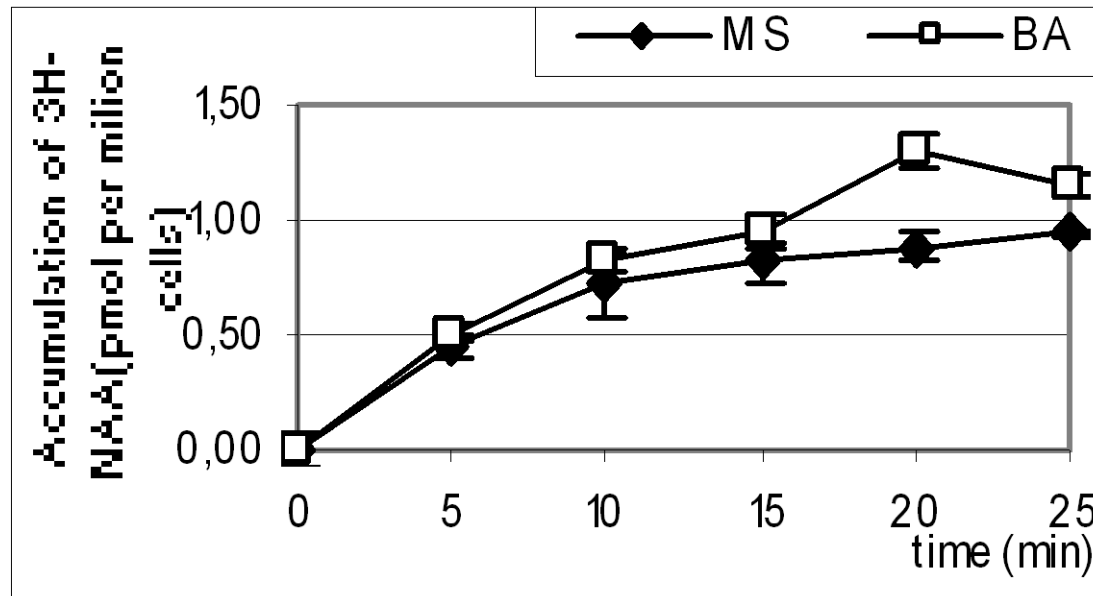
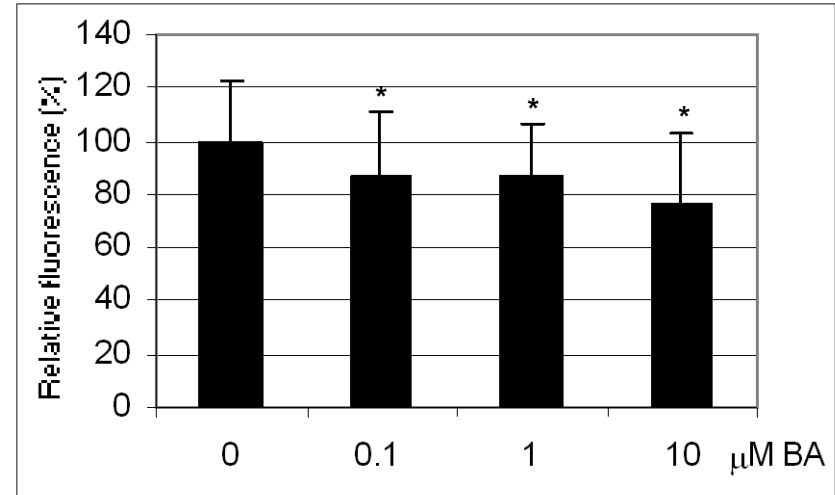
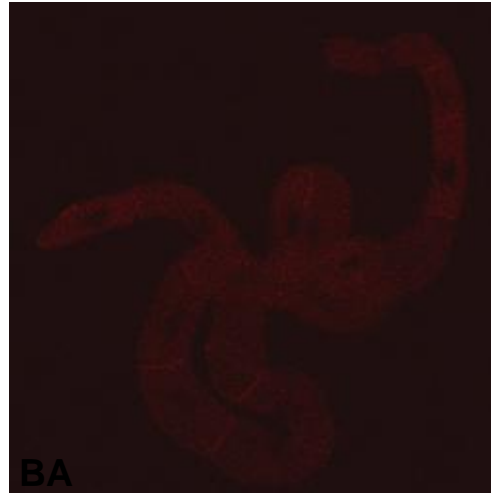
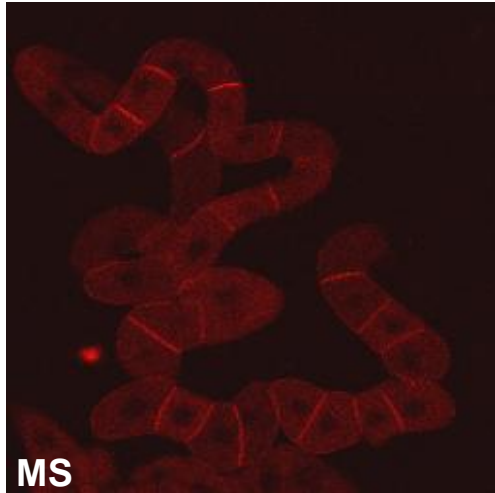


PIN7:GFP (24h)

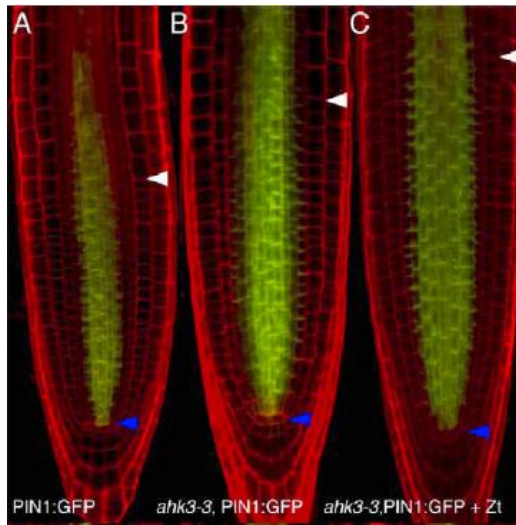


Cytokinin reduces auxin efflux in tobacco BY2 cells

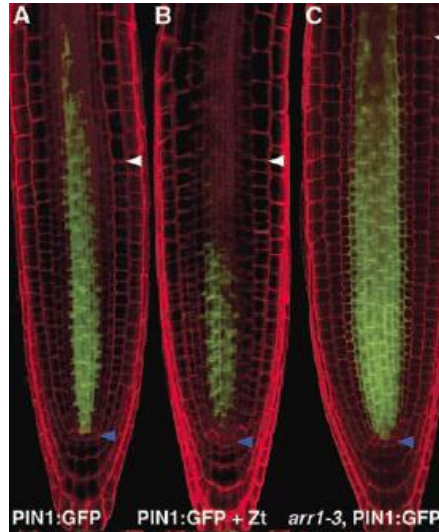
PIN1:RFP



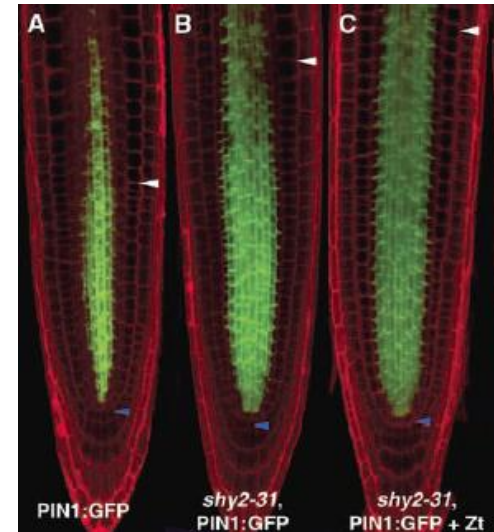
CK – auxin signalling pathways interaction to modulate auxin transport



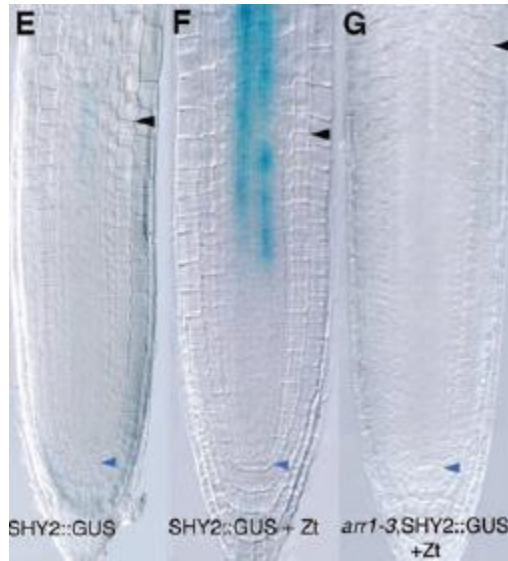
CK receptor



CK response regulator

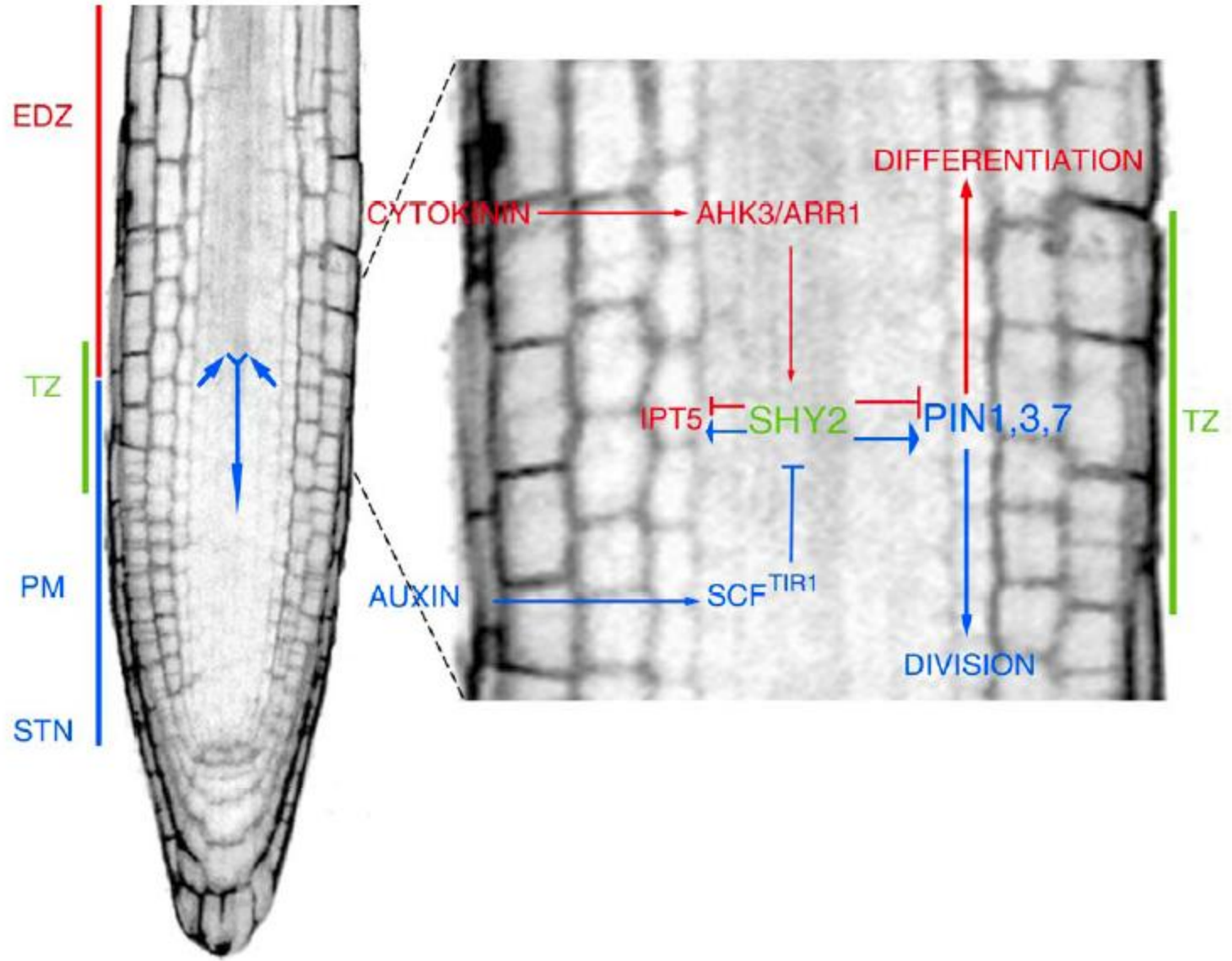


AUX/IAA negative regulator

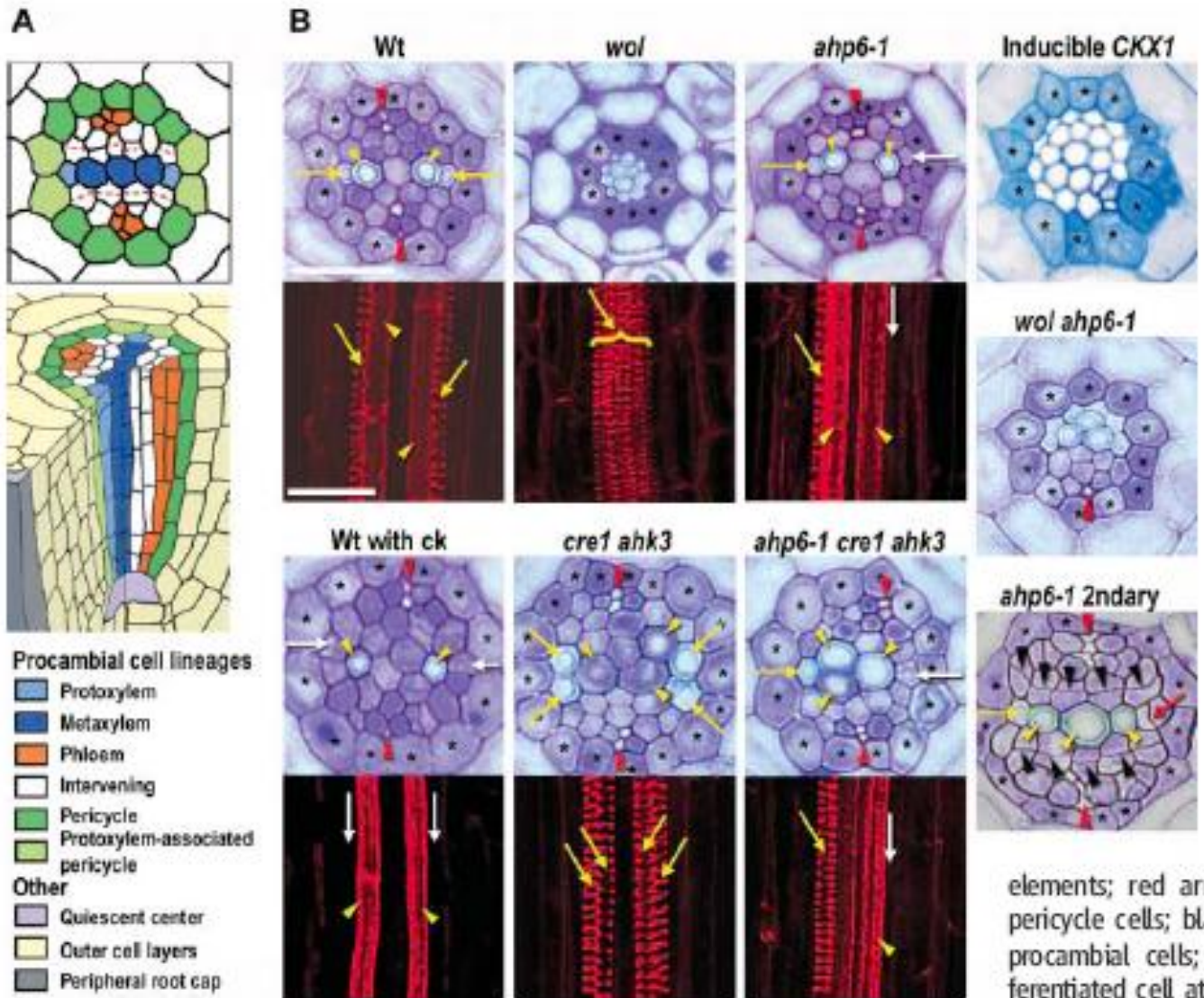


Expression of IAA3/SHY2 is CK regulated

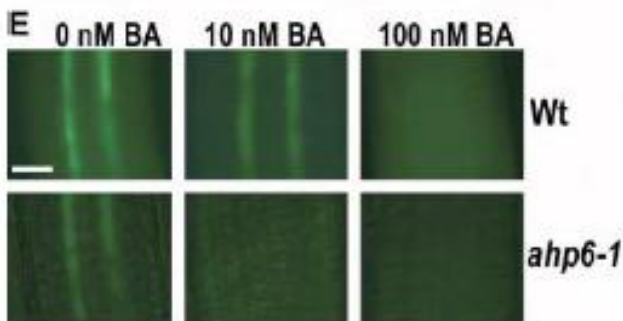
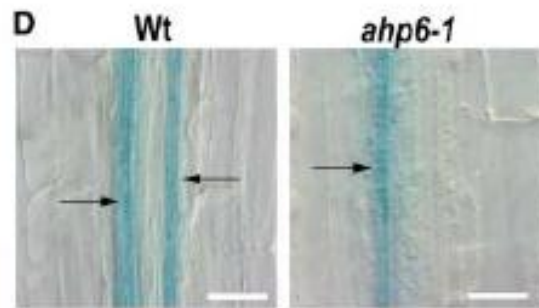
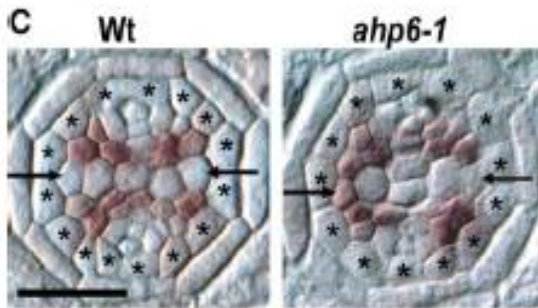
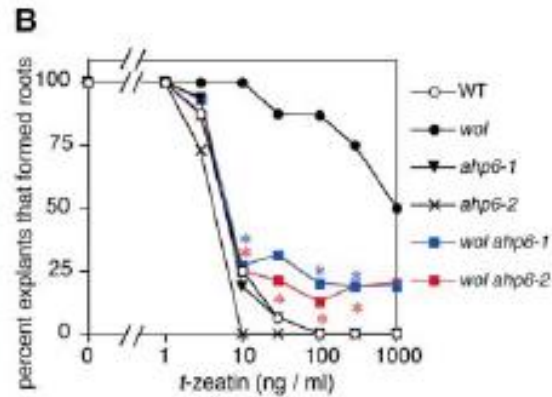
Model of cytokinin and auxin interaction in root meristem



Cytokinin signalling regulates vascular development

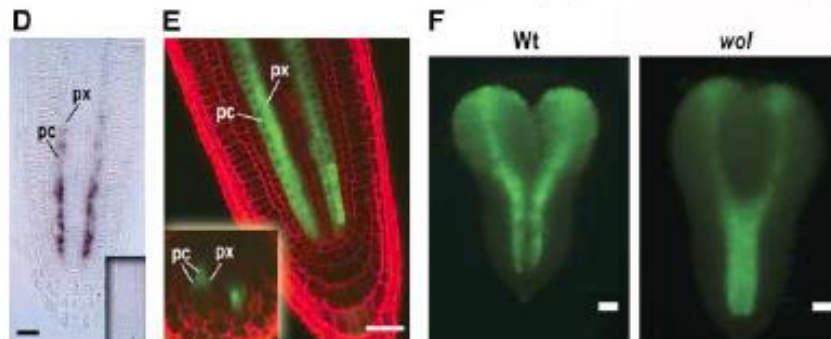
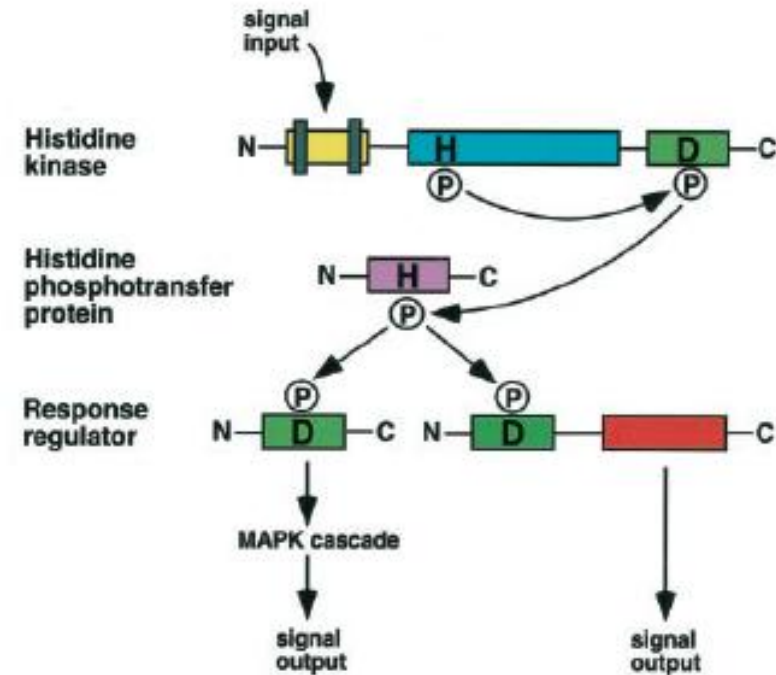
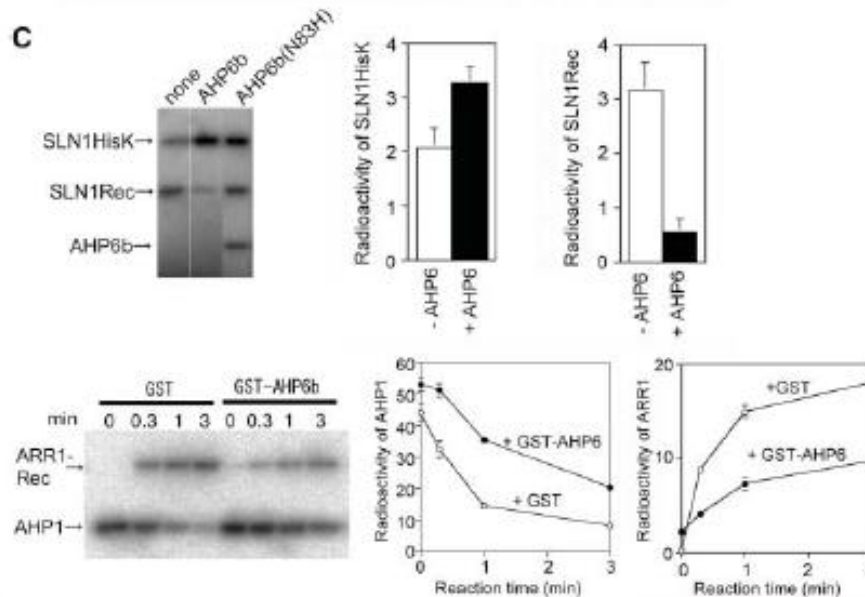
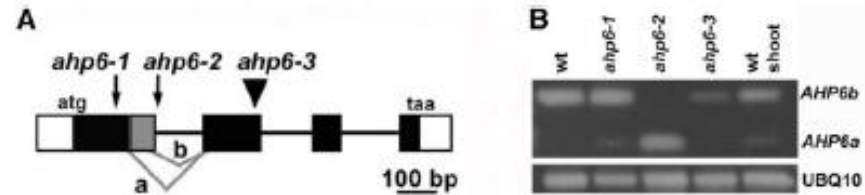


ahp6 suppress *wol* insensitivity to cytokinin

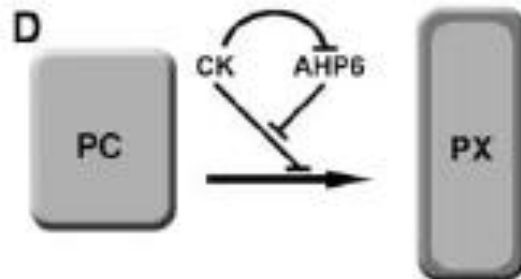
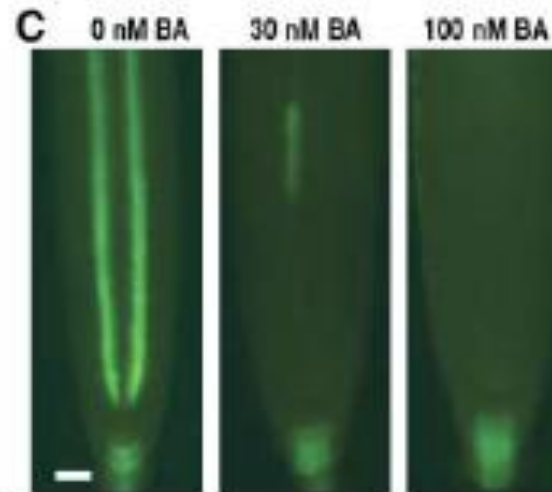
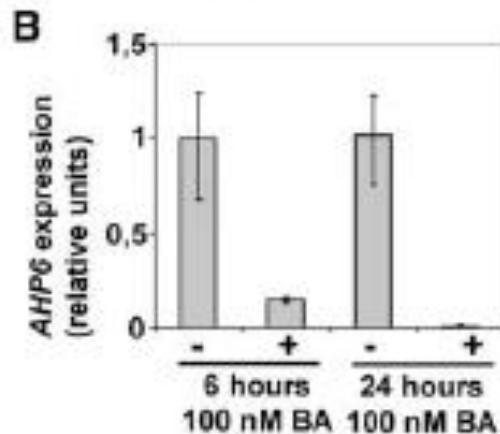
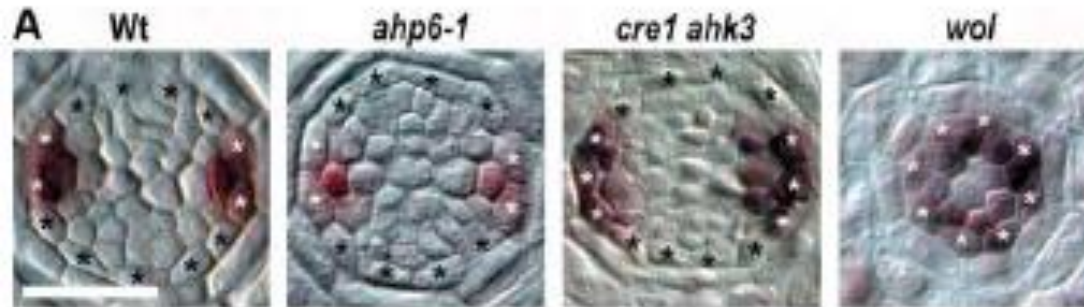


after a 48-hour treatment of benzyladenine, with 15 to 20 individuals. Black arrow, p bars, (A) 5 mm; (C) to (E), 20 μ m.

AHP6 codes for histidine phosphotransfer protein 6



AHP6 is negative regulator of cytokinin signalling



in a sporadic manner. Panels shown formed with 15 to 20 individuals. (| reciprocal interaction of cytokinin regulating the balance between the m cell identity (PC) and the differentiatio (PX). Scale bars, 20 μ m.