



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

Root Development

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Root System & Development

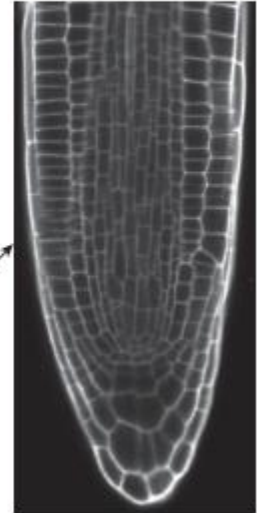
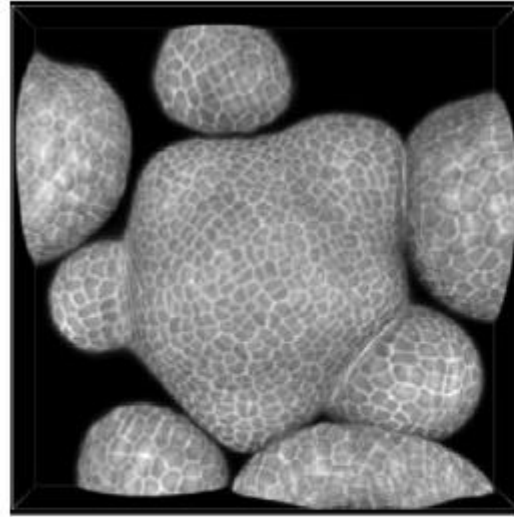
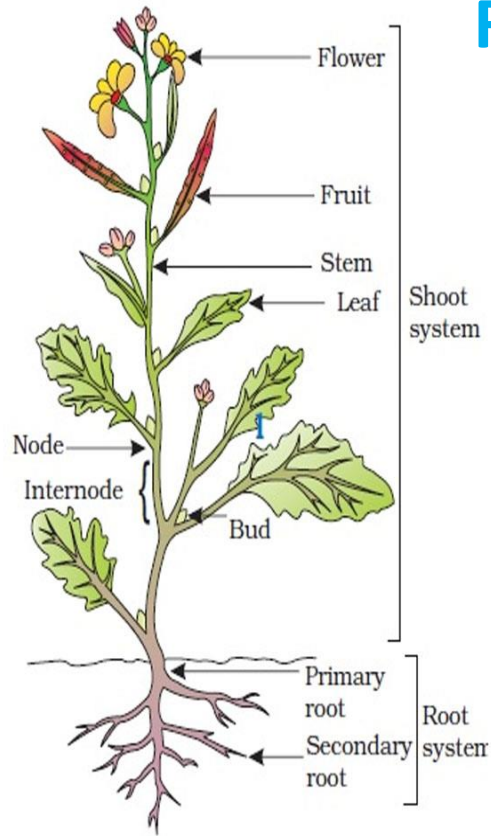
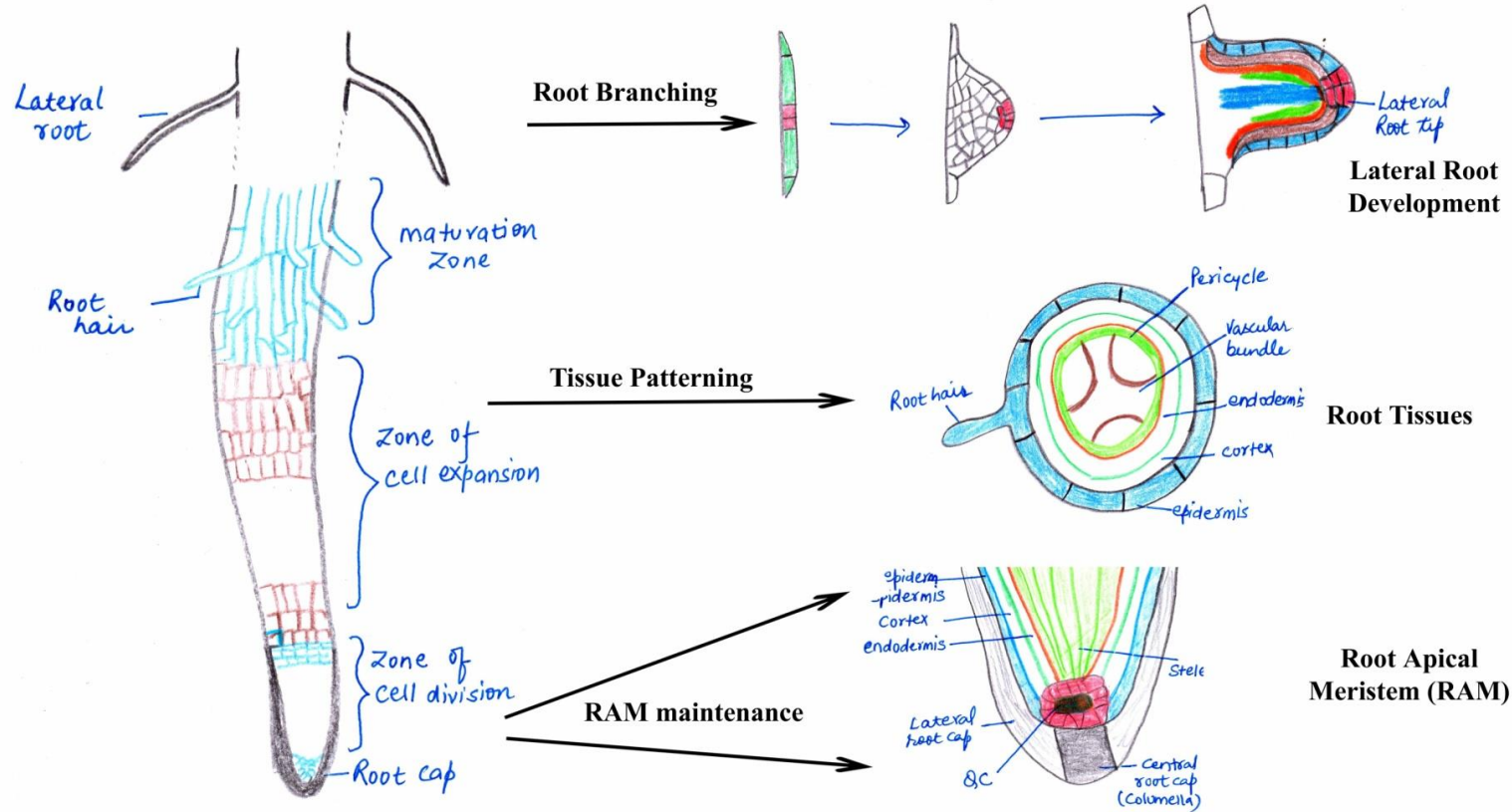


Image Source: Gailloch et Lohmann (2015), Development, 142, 2237-49.

Image Source: NCERT, Class XI, Biology

Root System & Development



Cellular Organization of Root

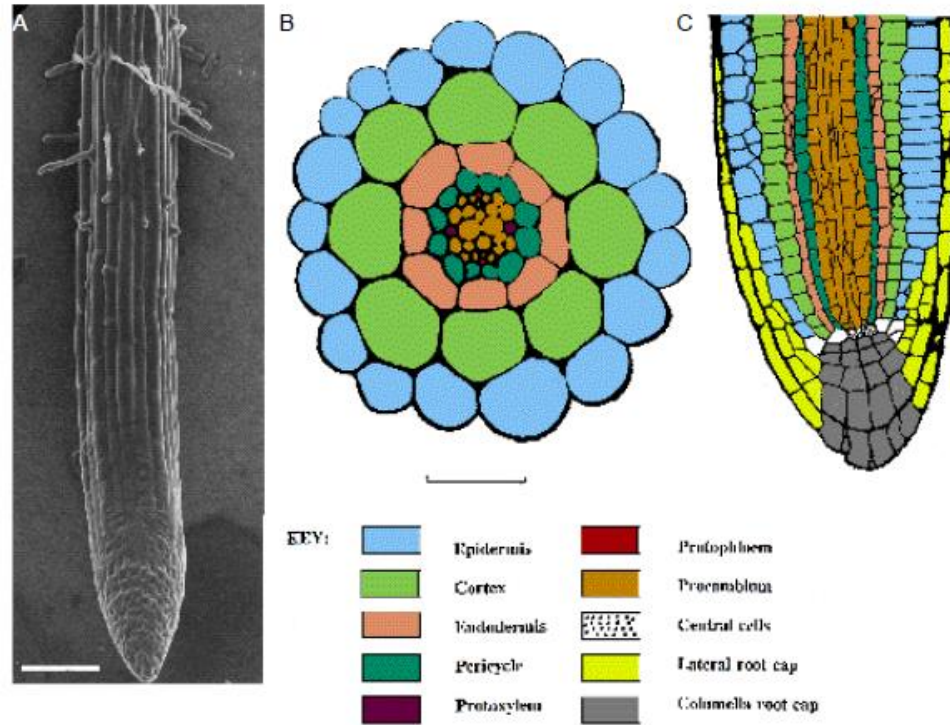


Image Source: Dolan et al. (1993), Development 119, 71-84.

Root Apical Meristem Establishment

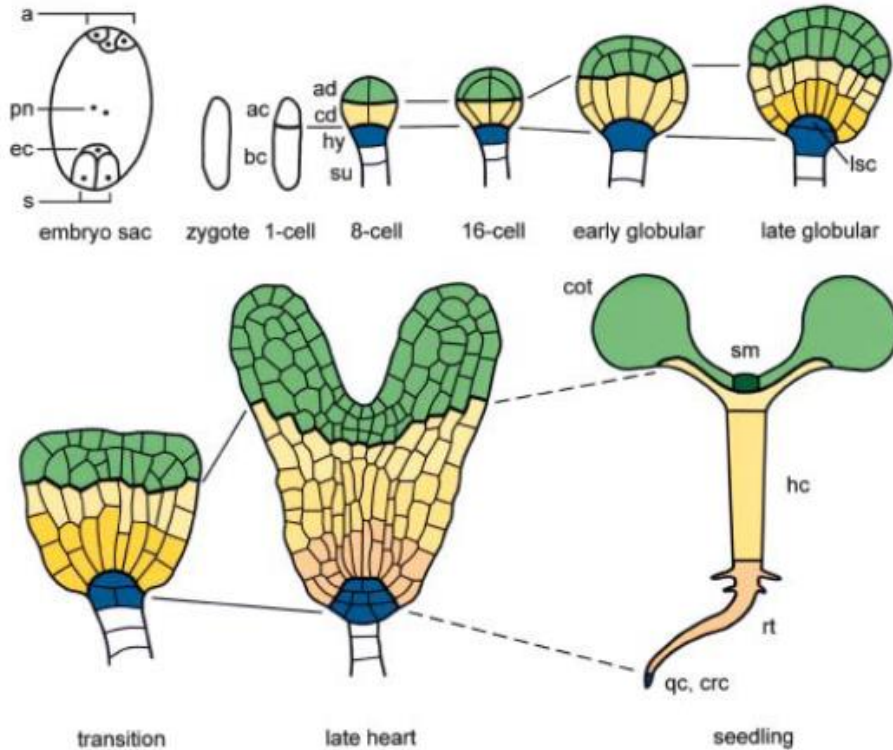


Image Source: Laux et al. (2004), Plant Cell, 16, S190–S202.

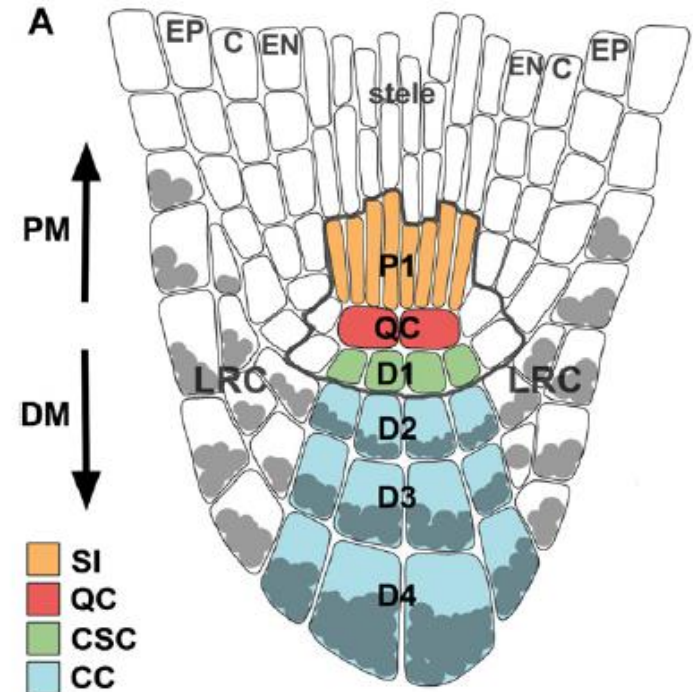


Image Source: Stahl et al. (2009), Current Biology 19, 909–14.

QC inhibits differentiation of columella initials

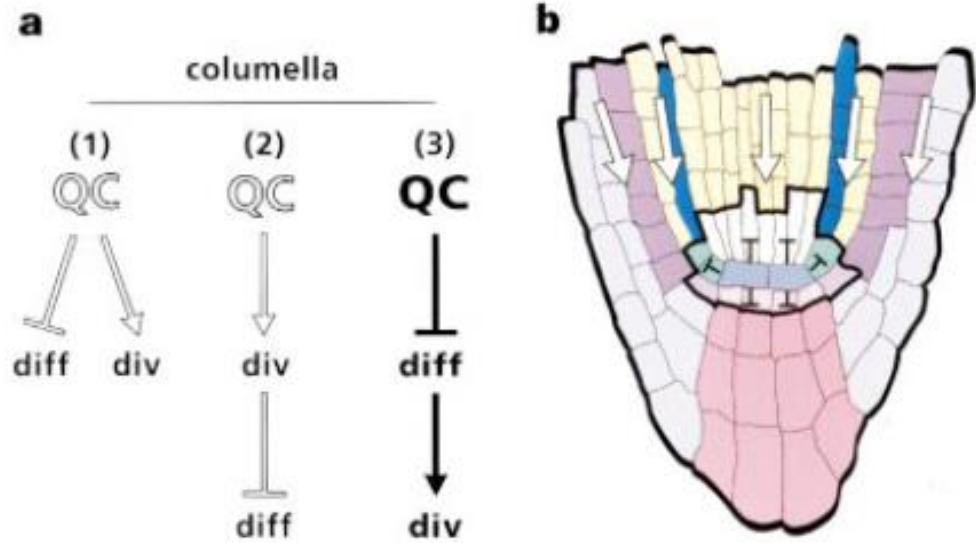
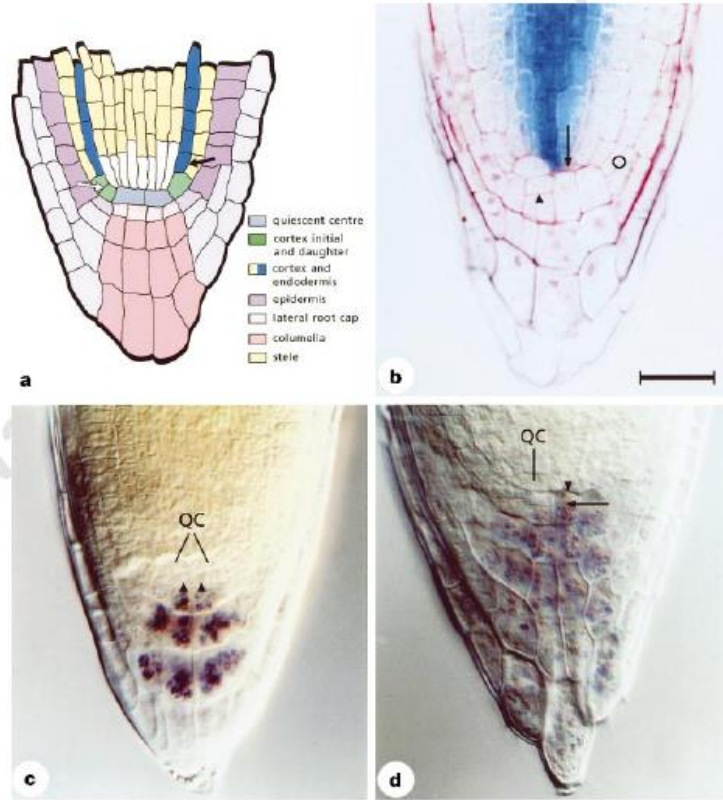


Image Source: van den Berg et al. (1997), Nature, 390, 287–89.

Root Stem Cell Niche Positioning

SCARECROW is involved in positioning the stem cell niche in the *Arabidopsis* root meristem

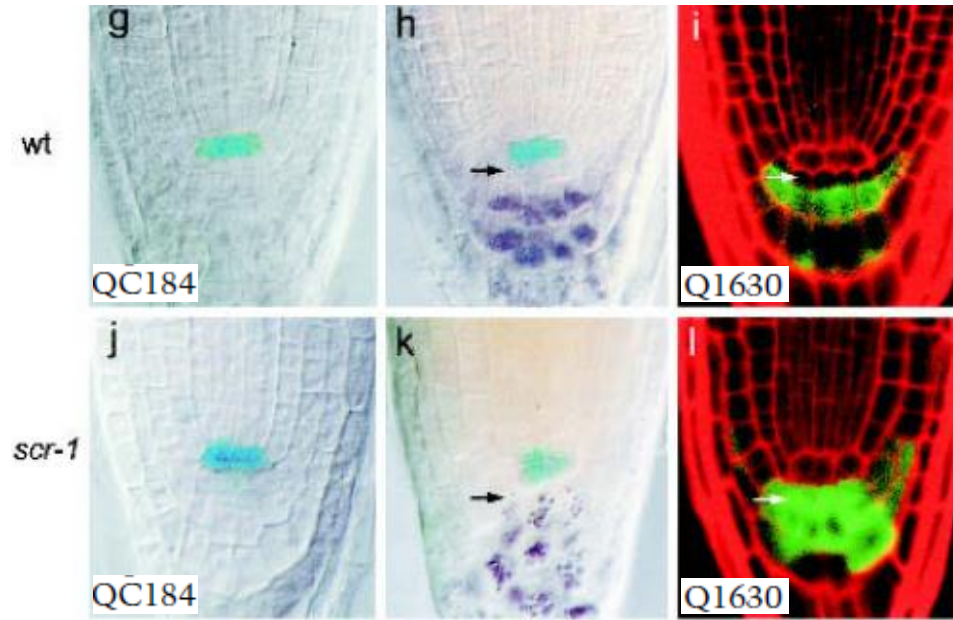
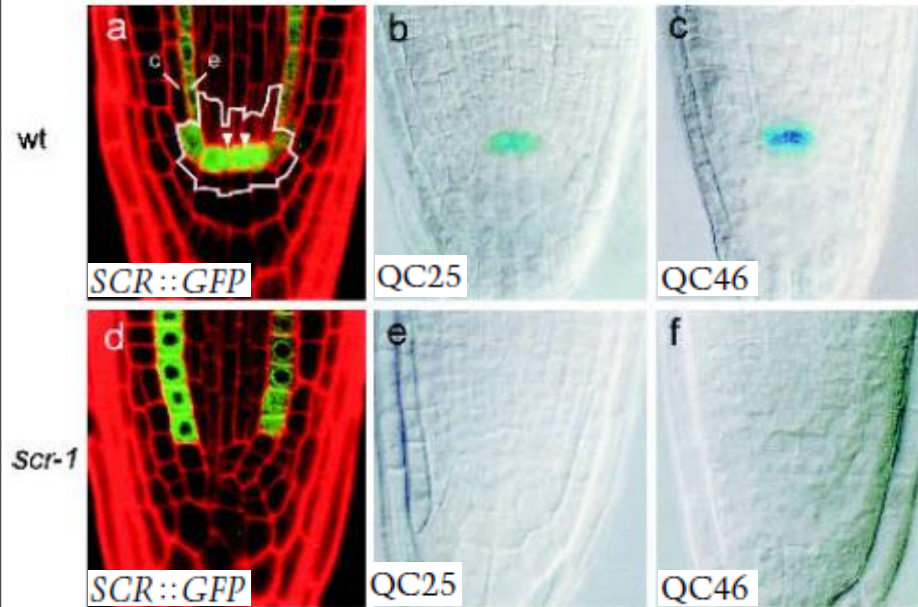
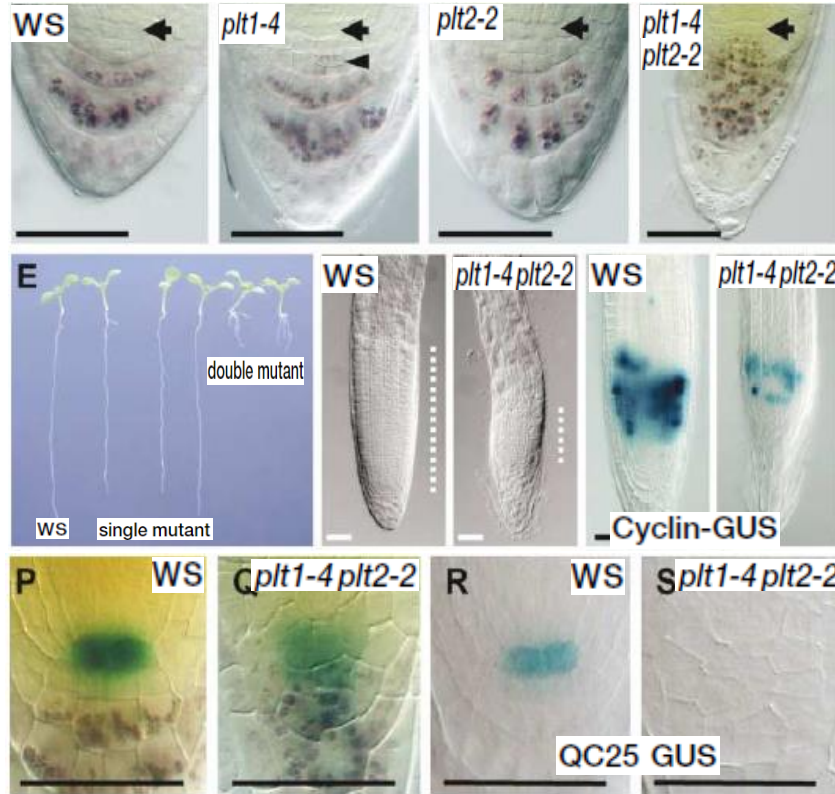


Image Source: Sabatini et al. (2003),
GENES & DEVELOPMENT 17:354–58.

Root Stem Cell Niche Positioning



The *PLETHORA* Genes Mediate Patterning of the *Arabidopsis* Root Stem Cell Niche

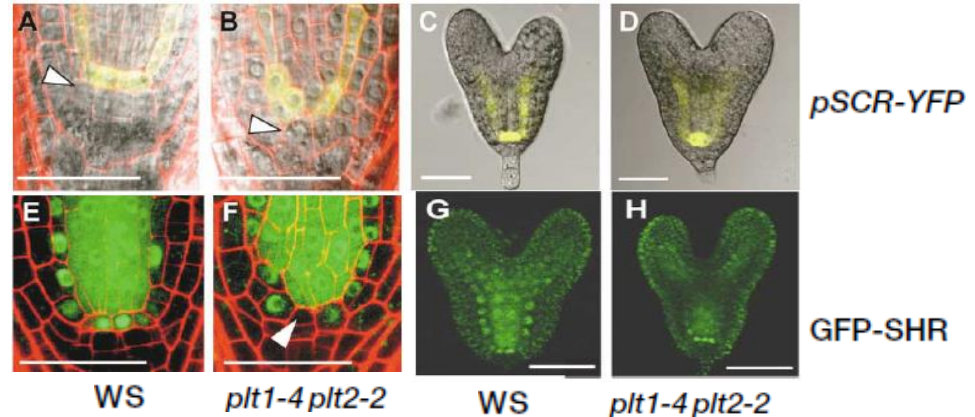


Image Source: Aida et al. (2004), *Cell*, 119, 109–20.

Root Stem Cell Niche Positioning

SHR/SCR pathway: radial positioning of QC
PLT pathway: longitudinal positioning of QC

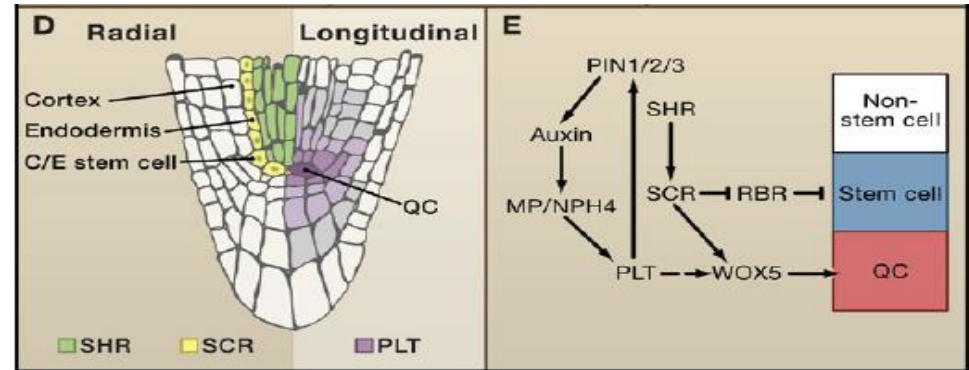
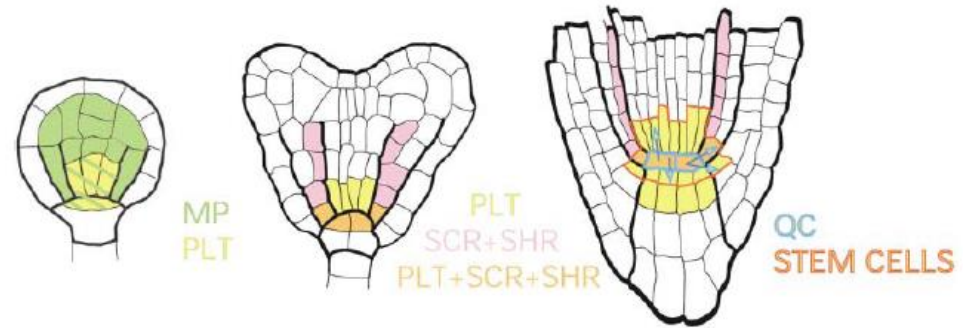
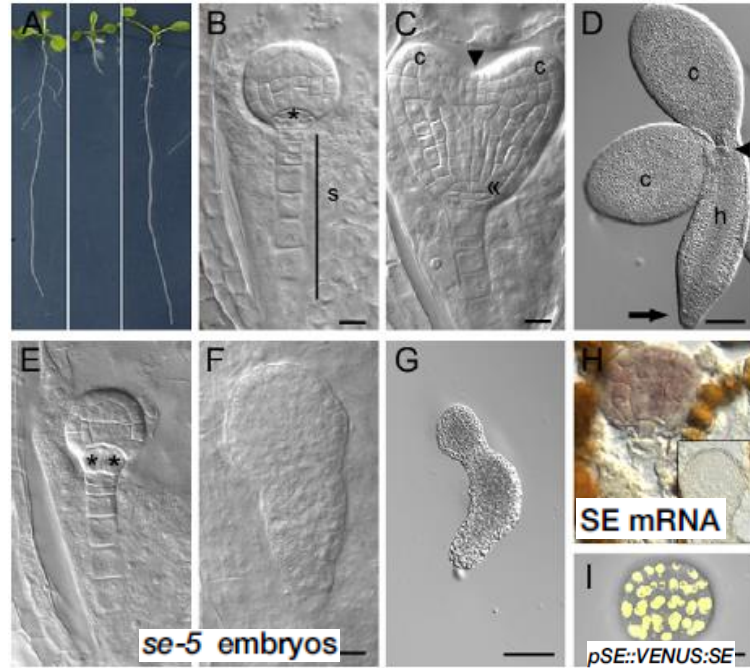


Image Source:

Aida et al. (2004), Cell, 119, 109–20.

Dinneny & Benfey (2008) Cell, 132, 553-57.

Repression of Apical Homeobox Genes Is Required for Embryonic Root Development in *Arabidopsis*



nuclear zinc-finger protein SERRATE

PHB mRNA

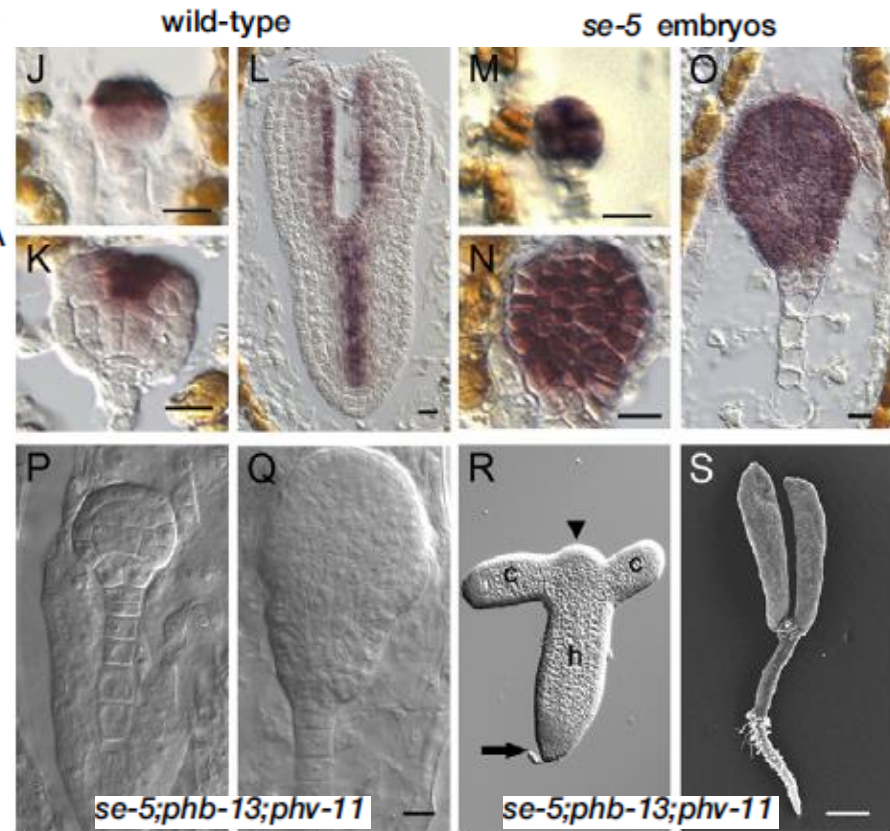


Image Source: Grigg et al. (2009), Current Biology 19, 1485–90.

Repression of Apical Homeobox Genes Is Required for Embryonic Root Development in *Arabidopsis*

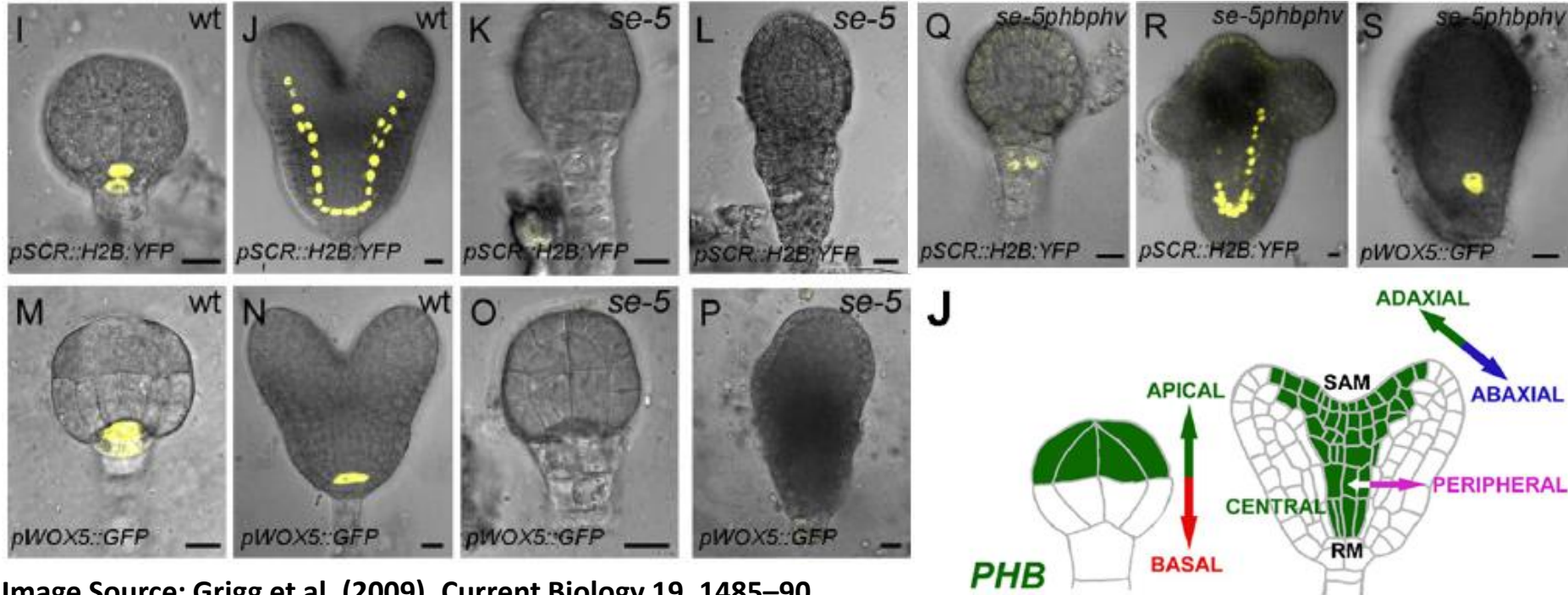


Image Source: Grigg et al. (2009), Current Biology 19, 1485–90.

RAM Maintenance: WOX5-CLE40-ACR4 module

WOX5

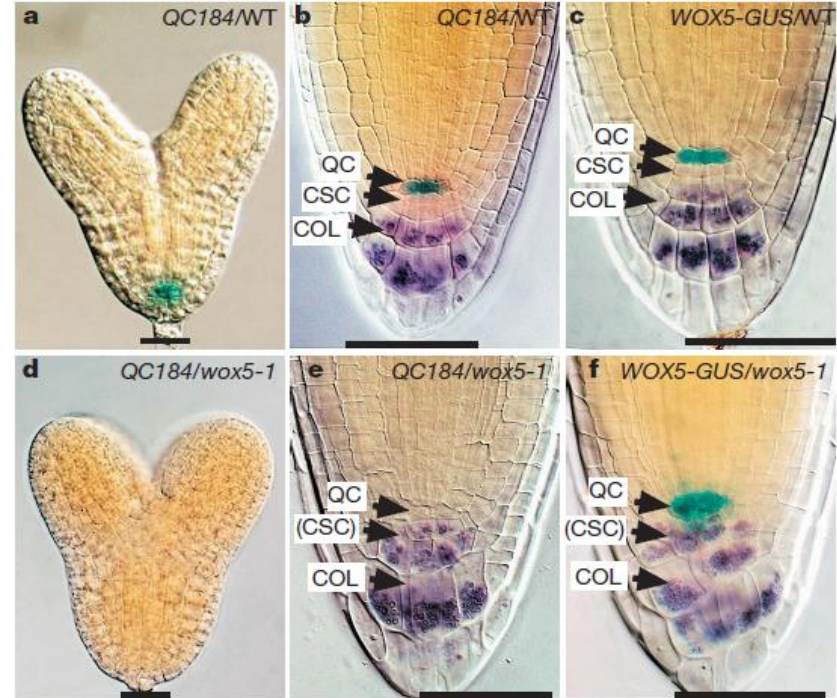
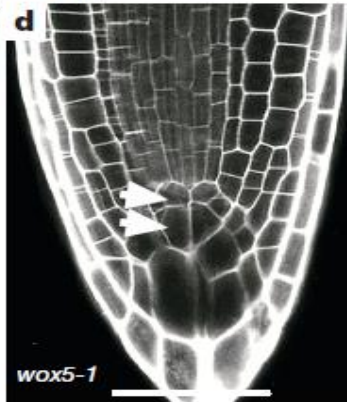
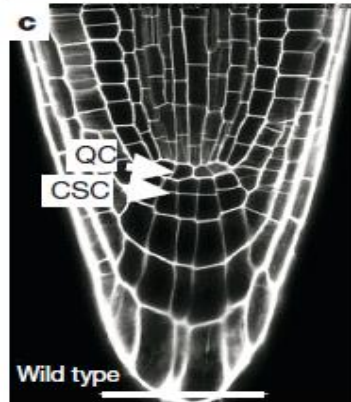
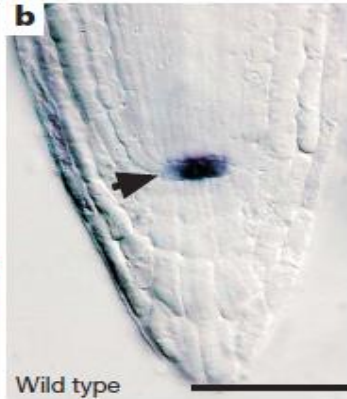
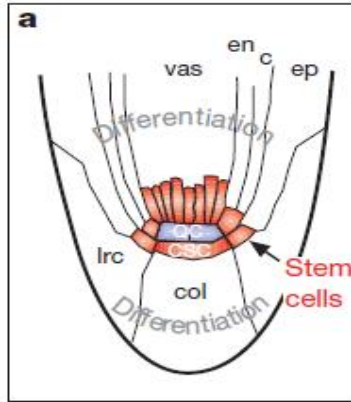
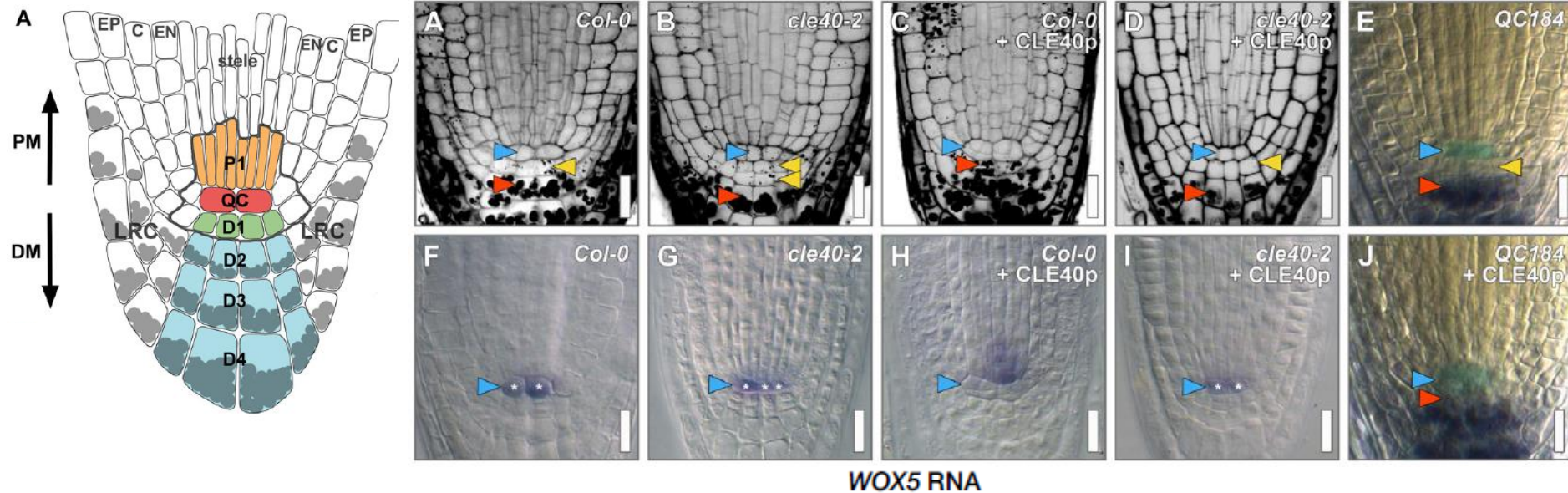


Image Source: Sarkar, Luijten et al. (2007),
Nature, 446, 811–15.

RAM Maintenance: WOX5-CLE40-ACR4 module

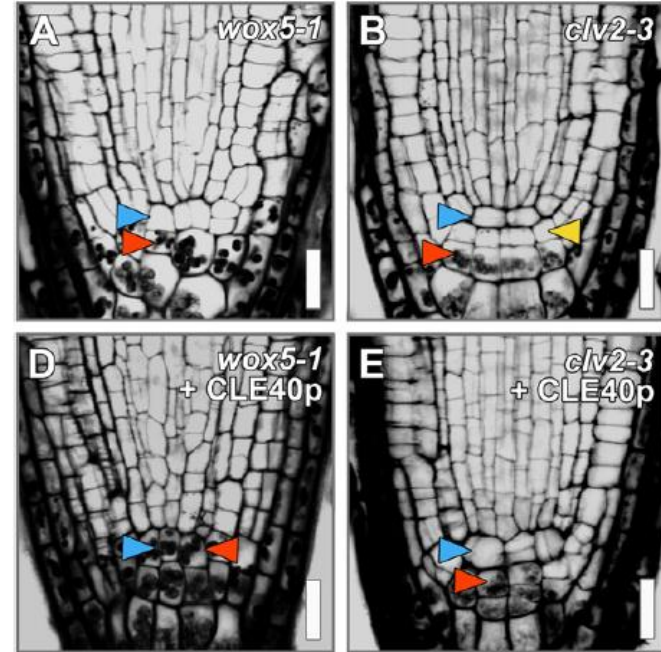
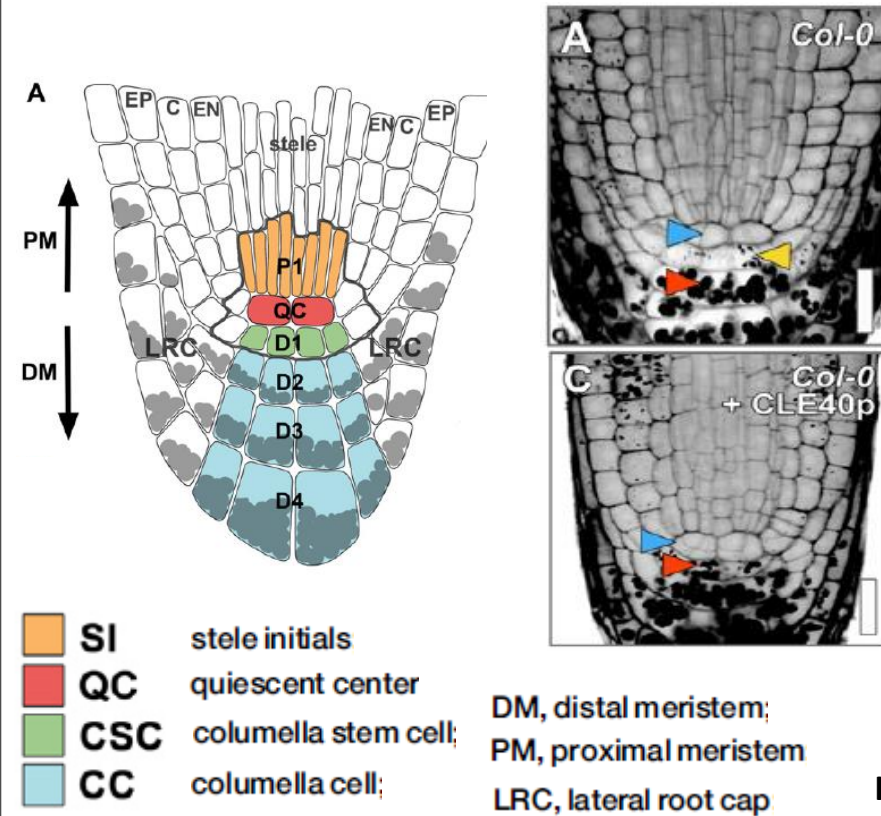


- SI** stele initials
 - QC** quiescent center
 - CSC** columella stem cell;
 - CC** columella cell;
- DM, distal meristem;
PM, proximal meristem
LRC, lateral root cap

CLE40 (CLAVATA3/EMBRYO SURROUNDING REGION40)

Image Source: Stahl et al. (2009), Current Biology 19, 909–14.

RAM Maintenance: WOX5-CLE40-ACR4 module



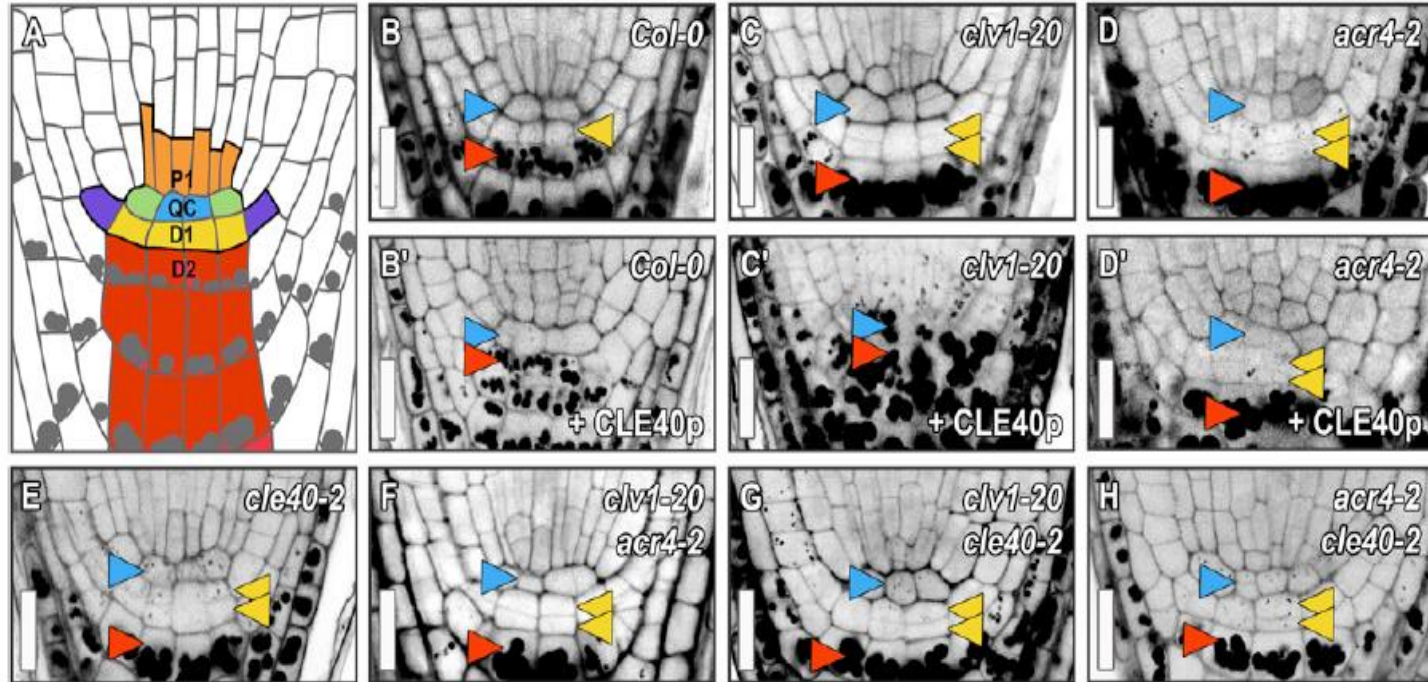
arrowheads: blue, QC position; yellow, CSC; red, CC

Image Source: Stahl et al. (2009), Current Biology 19, 909–14.

RAM Maintenance: WOX5-CLE40-ACR4 module

CLAVATA1 (CLV1)

ARABIDOPSIS CRINKLY4 (ACR4)



arrowheads: blue, QC position; yellow, CSC; red, CC

Image Source: Stahl et al. (2013), Current Biology 23, 362–71.

RAM Maintenance: WOX5-CLE40-ACR4 module

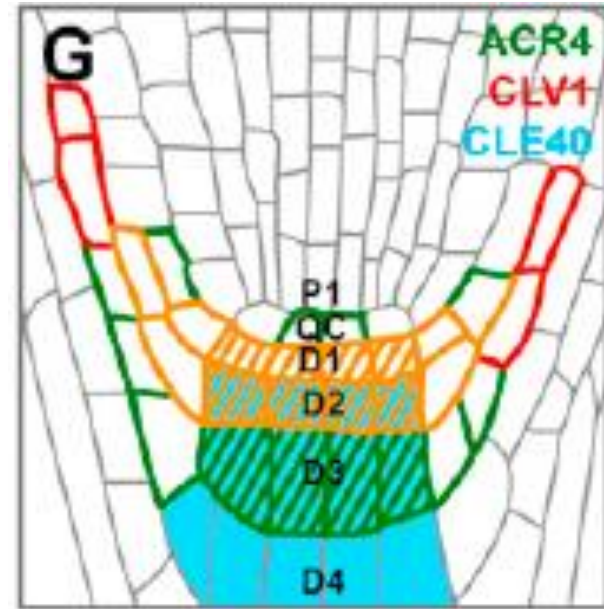
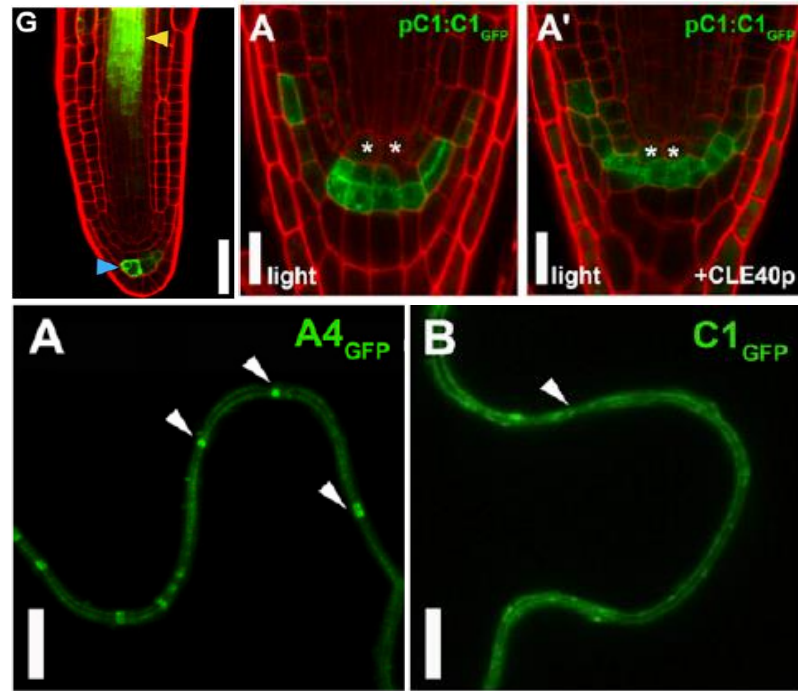
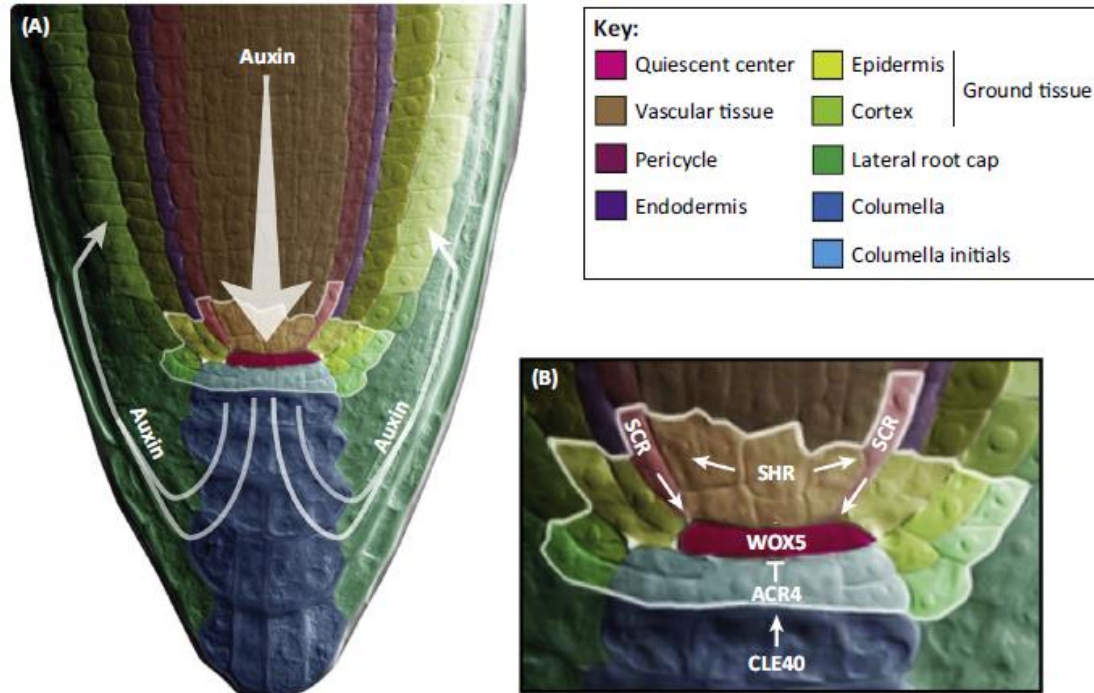


Image Source: Stahl et al. (2009), Current Biology 19, 909–14.
Stahl et al. (2013), Current Biology 23, 362–71.

RAM Positioning and Maintenance



TRENDS in Cell Biology

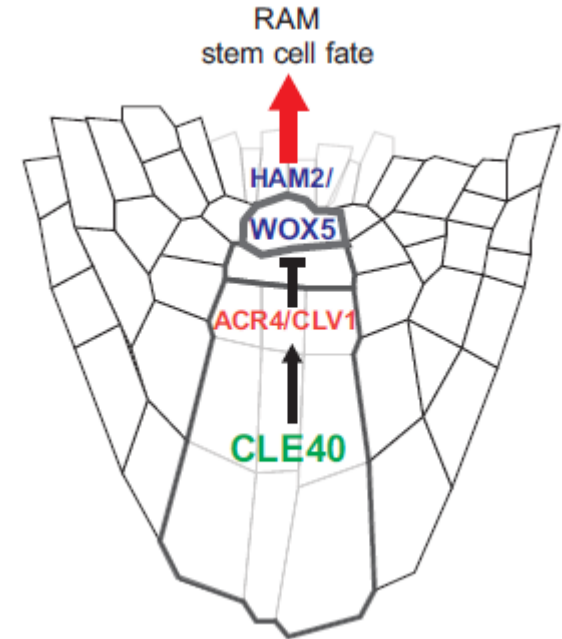


Image Source: Gailloch et al. (2015), *Development*, 142, 2237-49.

Image Source: Heyman et al. (2014), *Trends in Cell Biology*, 24, 443-48.

Hormonal Regulation of RAM activity

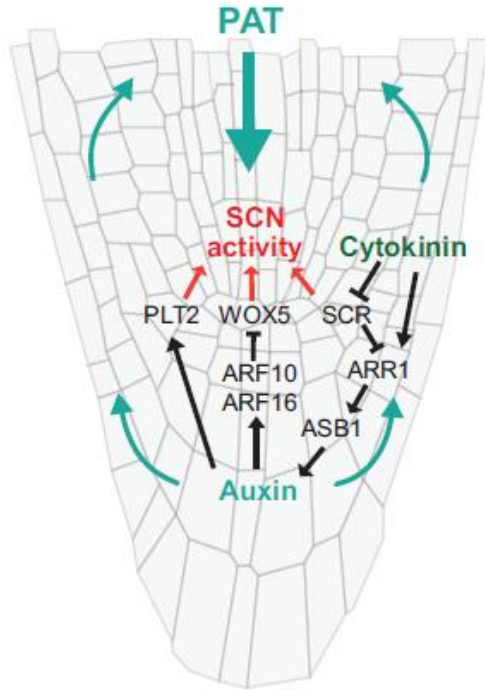


Image Source: Gailliochet & Lohmann (2015), Development, 142, 2237-49.

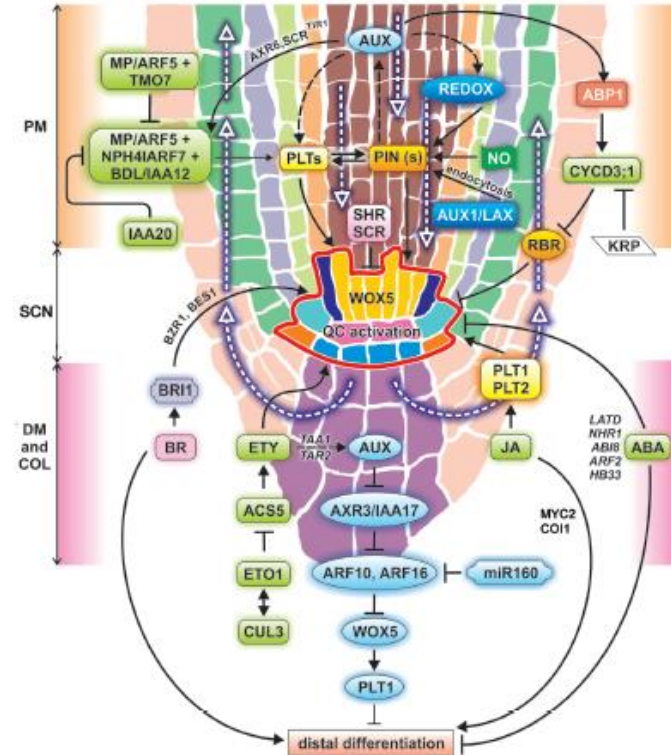


Image Source: Lee et al. (2013), J Exp Bot., 64, 1153-65.

Control of QC quiescence

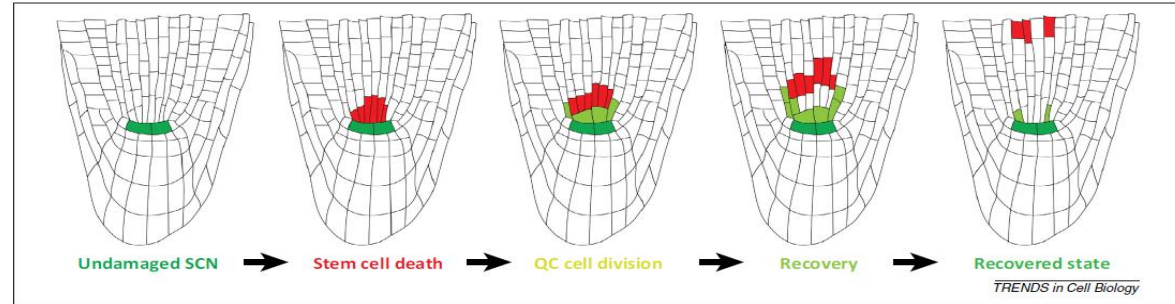


Image Source: Heyman et al. (2014),
Trends in Cell Biology, 24, 443-48.

Gaillochet & Lohmann (2015),
Development, 142, 2237-49.

