

MAPPING THE TOMATO ROOT GENE EXPRESSION IN DROUGHT AND WATERLOGGING



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UC DAVIS

1. TOMATO AS A CROP MODEL



TOMATO HAS

- A SEQUENCED GENOME
- TRANSCRIPTOME ATLASES
- GENETIC RESOURCES
- DROUGHT-TOLERANT INTER-CROSSABLE SPECIES WITH DEVELOPMENTAL DIFFERENCES

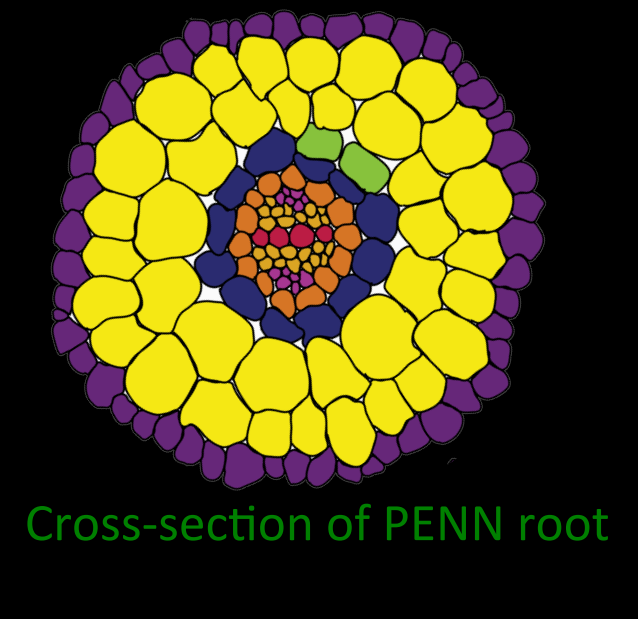
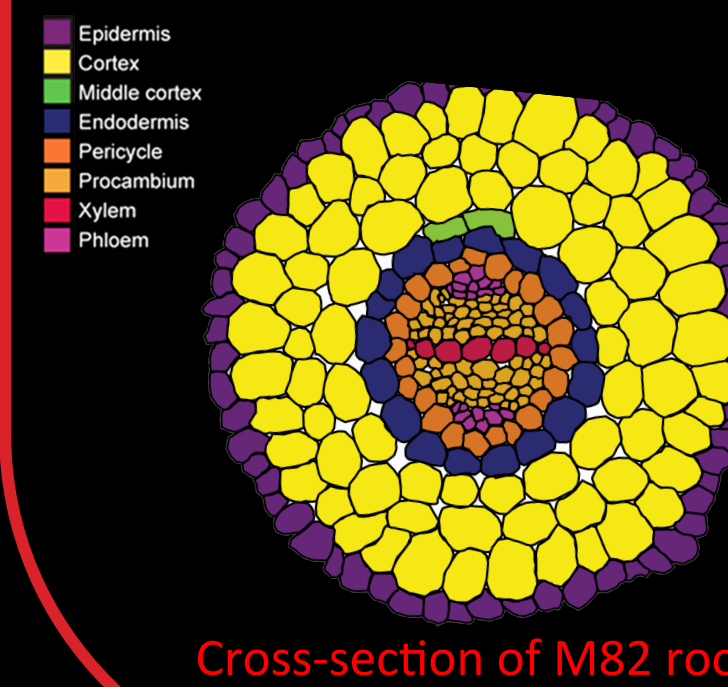
WE'VE BUILT MOLECULAR TOOLS FOR

CELL-TYPE SPECIFIC MULTI-LAYER PROFILING OF GENE EXPRESSION

TO STUDY ROOT RESPONSES TO WATER STRESSES.



Solanum pennellii "PENN"



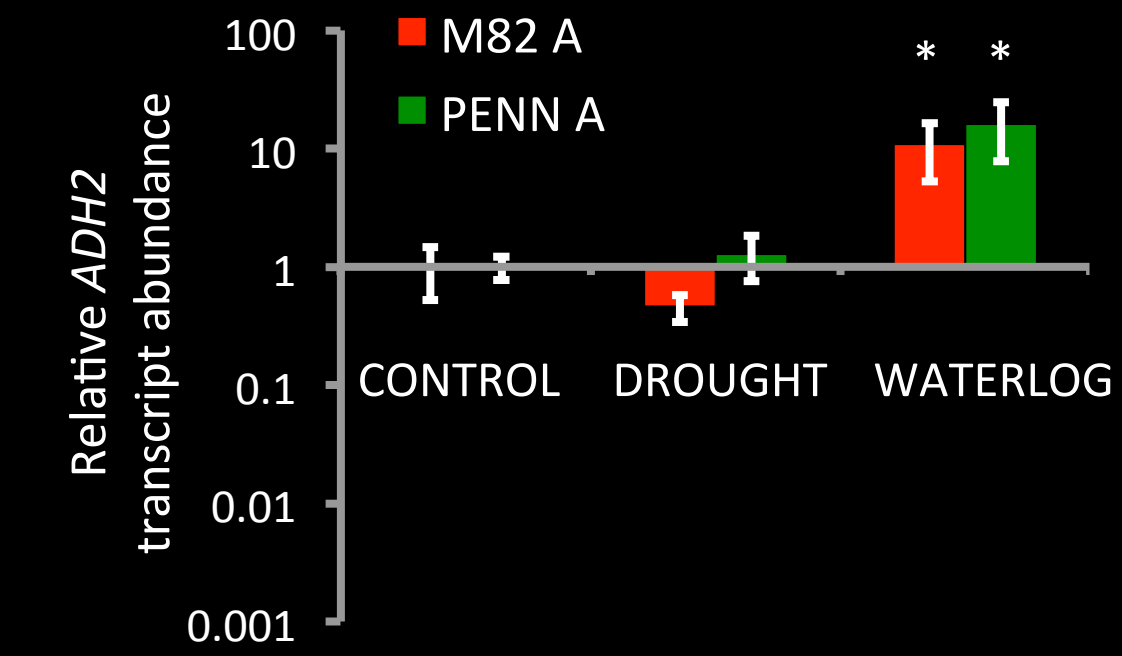
2. ROOT ARCHITECTURE AND EXODERMAL SUBERIN RESPOND TO WATER STRESS

WE TESTED THE EFFECT OF LONG-TERM DROUGHT AND WATERLOGGING ON ROOTS.

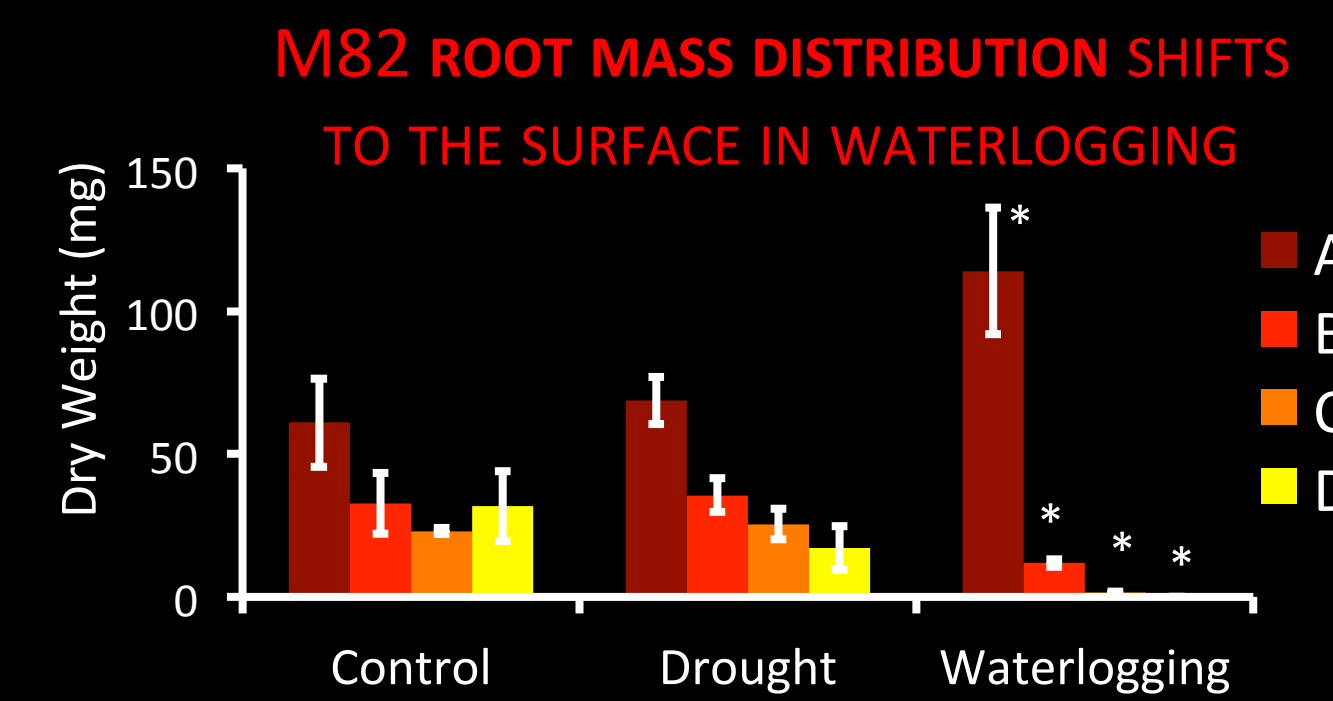
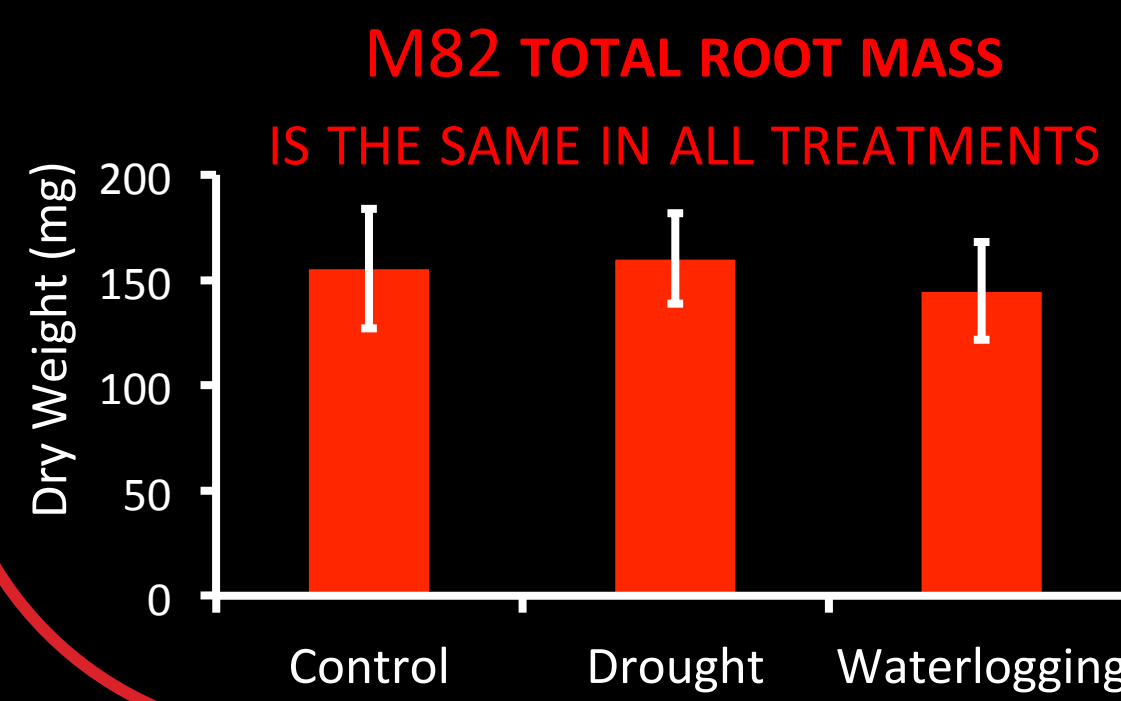
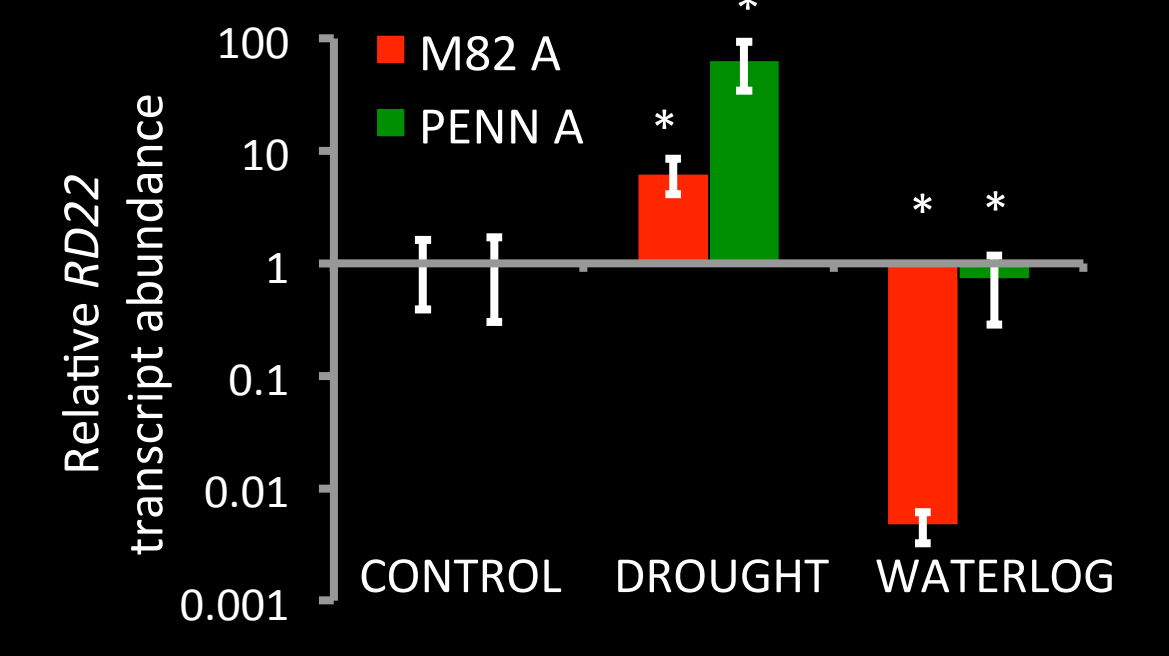
- Plants grown on clay media. 16 days well watered + 12 days treatment
- control (well watered)
 - drought (no water)
 - waterlogging (rootball submerged)
- Samples taken in 6 cm segments.



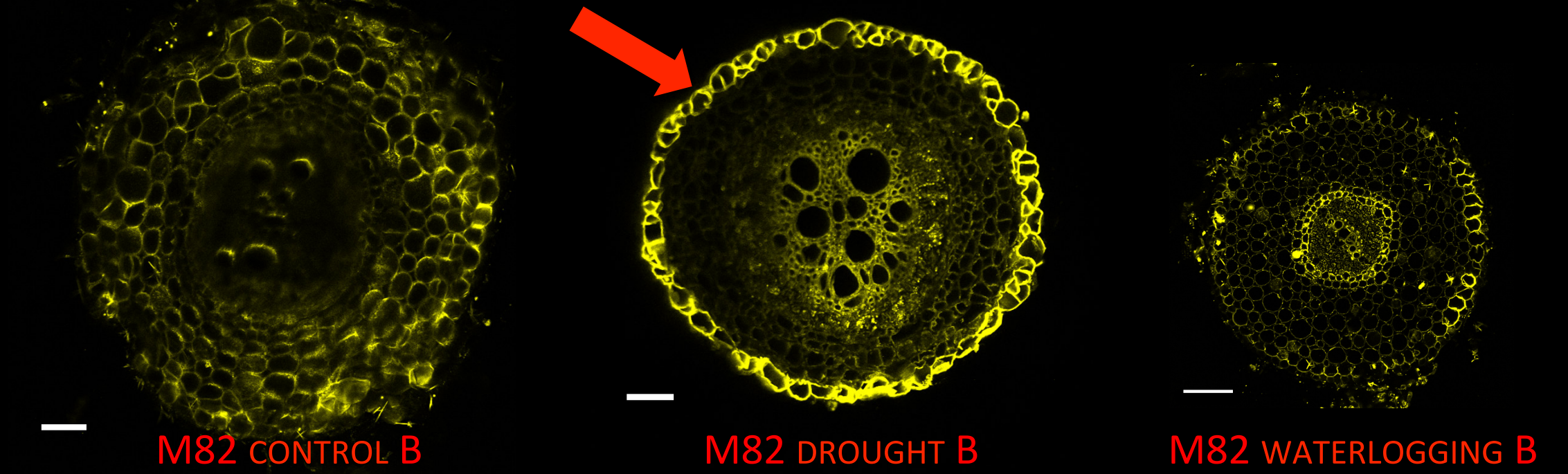
ANOXIA-RESPONSIVE TRANSCRIPT *ADH2* SHOWS ROOT RESPONSE TO WATERLOGGING



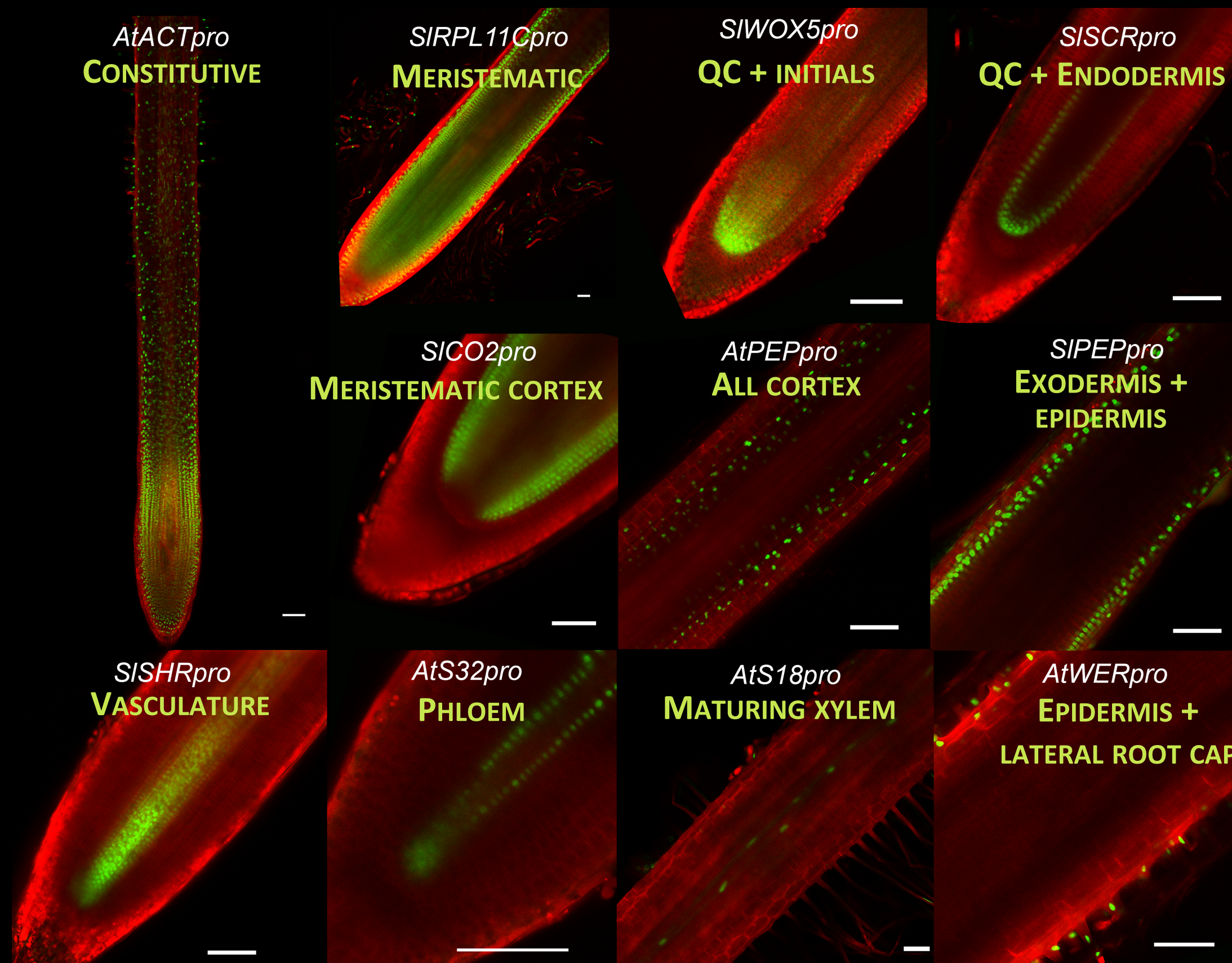
DROUGHT-RESPONSIVE TRANSCRIPT *RD22* REVEALS STEP-WISE STRESS RESPONSE



SUBERIN STAINING WITH FLUOROL YELLOW IN M82 ROOT SECTIONS SHOWS HIGHER EXODERMAL SUBERIN ACCUMULATION IN DROUGHT.



3. CELL-TYPE SPECIFIC PROMOTERS



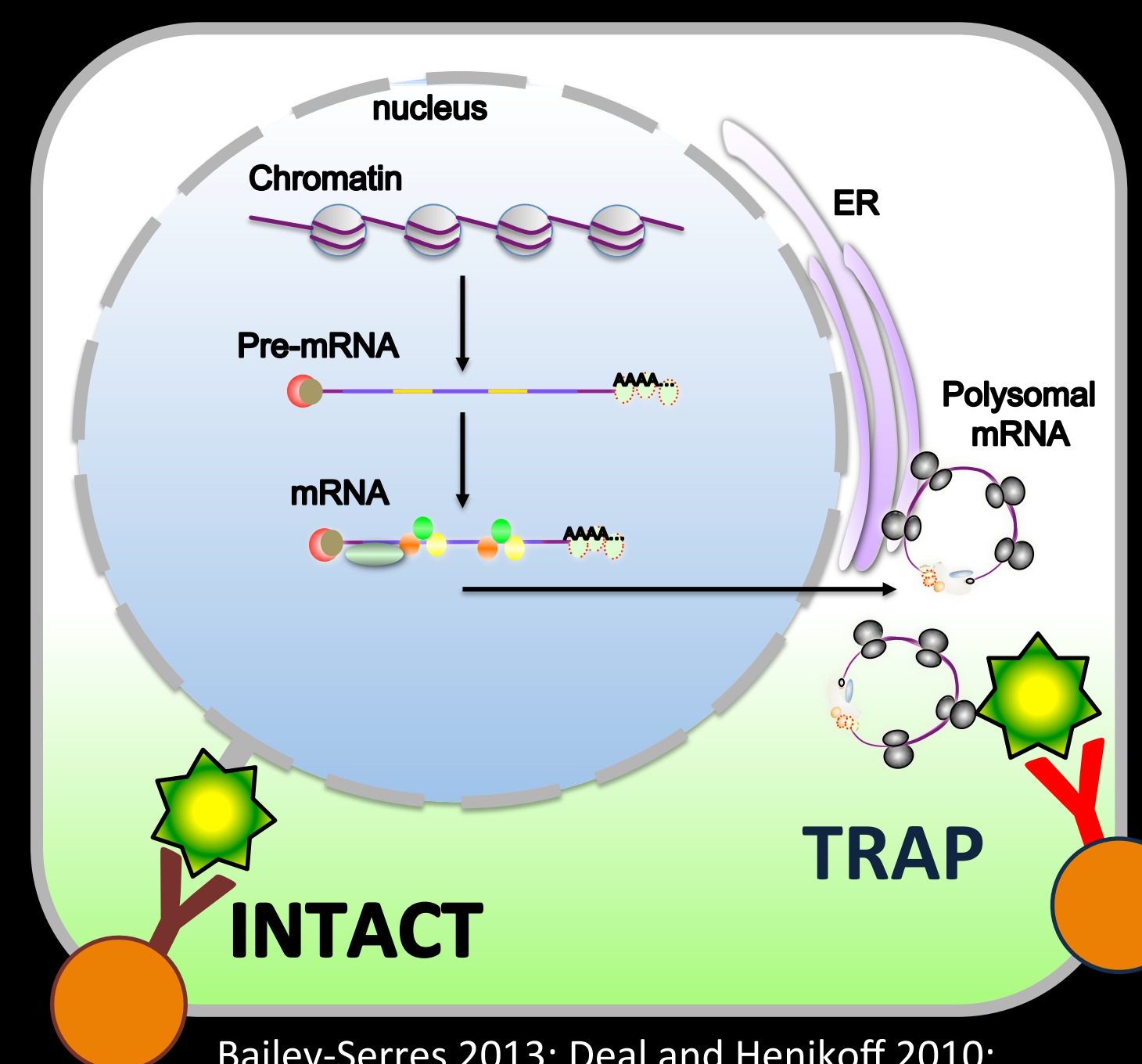
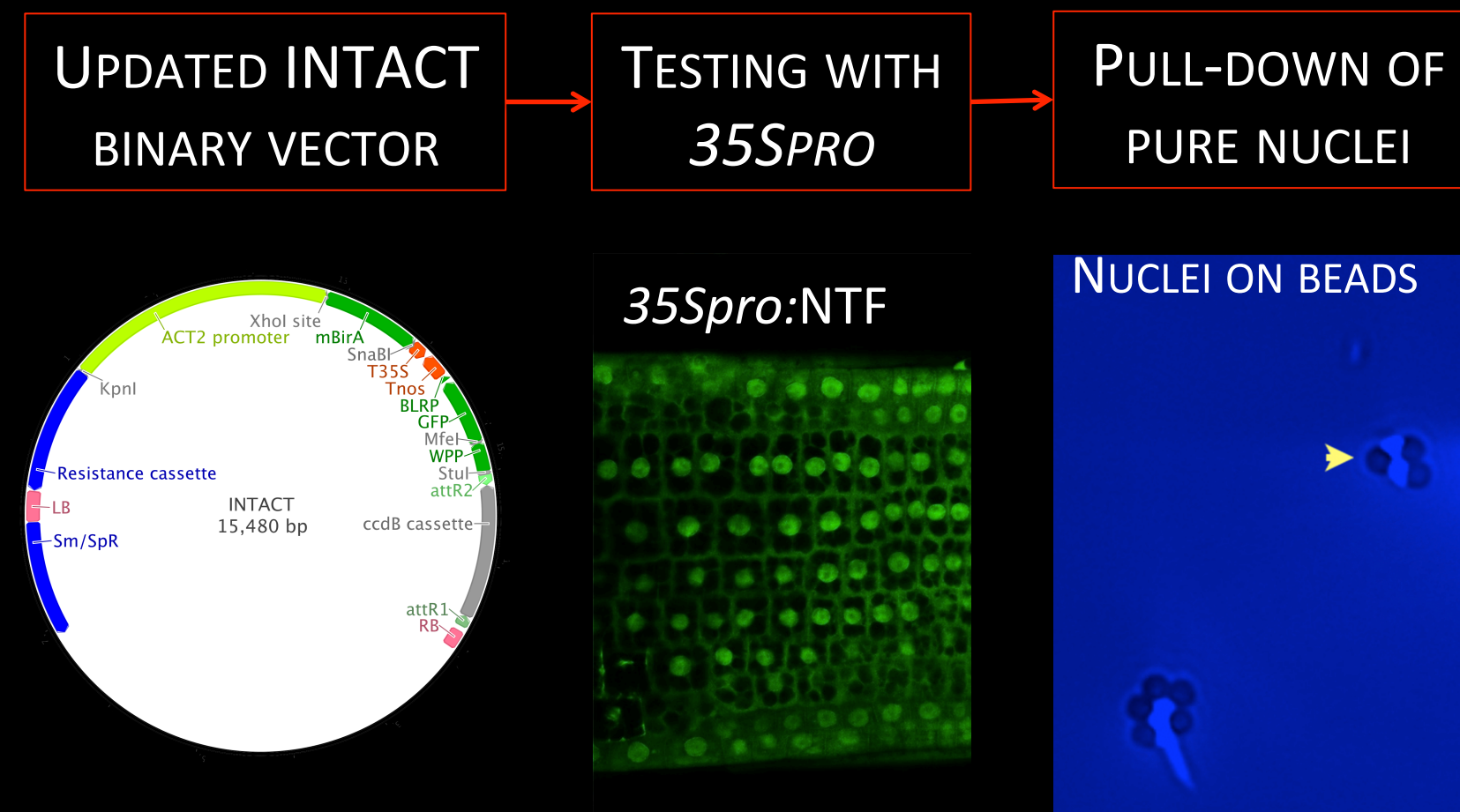
Promoter fusions with nuclear-localized green fluorescent protein were used to identify cell-type specific promoters. Constitutive plasma membrane-localized red fluorescent protein shown in red.

Ron, Kajala *et al.*, Plant Physiol, 2014

4. TOOLS FOR ISOLATING NUCLEI AND RIBOSOMES FROM SPECIFIC CELL-TYPES

INTACT: ISOLATION OF NUCLEI TAGGED IN CELL TYPES

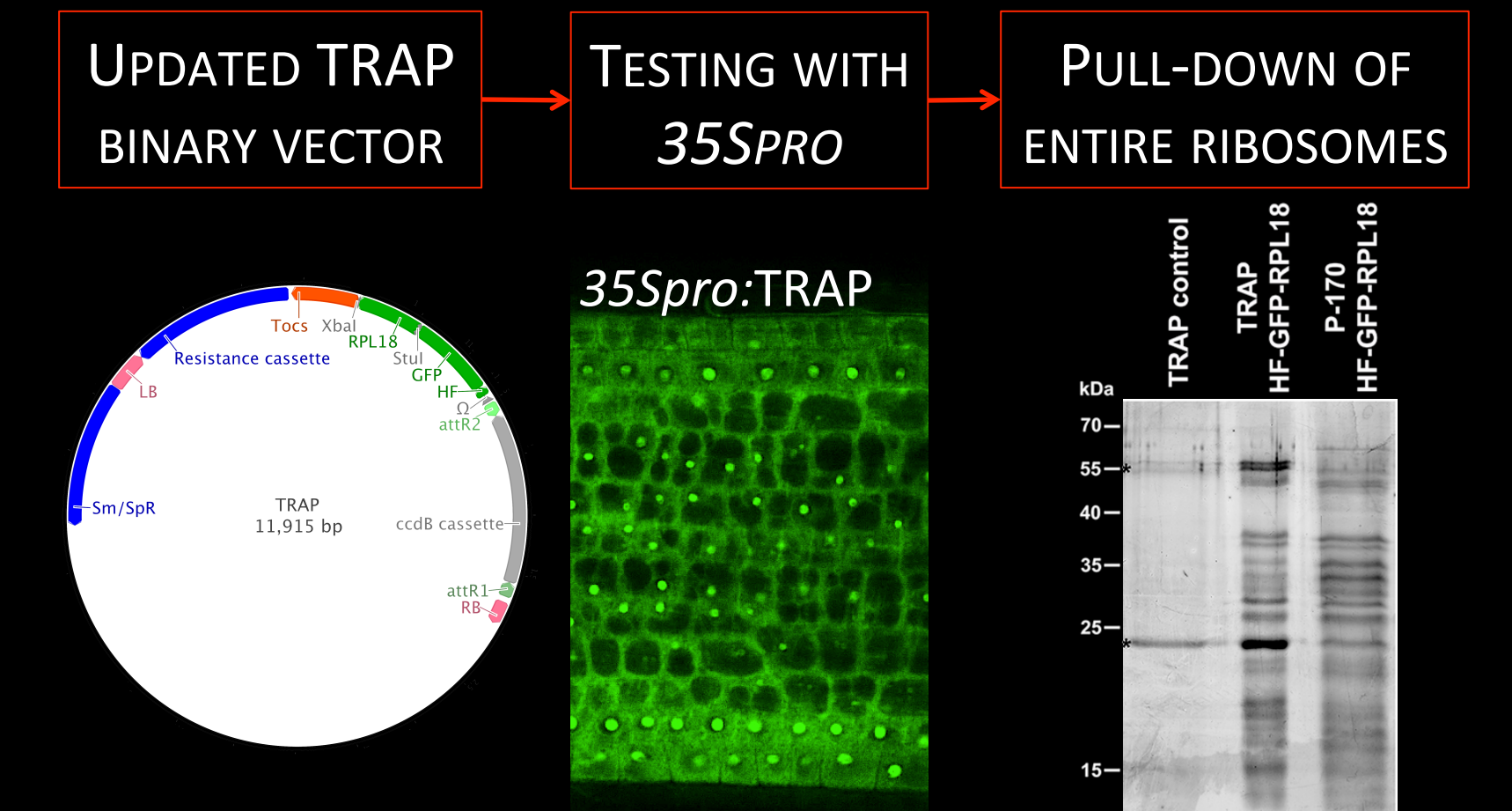
- 1) USE A PROMOTER TO EXPRESS A NUCLEAR BIOTIN TAG.
- 2) PULL DOWN THE NUCLEI WITH STREPTAVIDIN BEADS.
- 3) SUBSEQUENT ANALYSES: CHIP-SEQ, RNA-SEQ, ETC.



Bailey-Serres 2013; Deal and Henikoff 2010; Zanetti *et al.*, 2005; Mustroph *et al.*, 2009.

TRAP: TRANSLATING RIBOSOME AFFINITY PURIFICATION

- 1) USE A PROMOTER TO EXPRESS A RIBOSOME FLAG TAG.
- 2) PULL DOWN THE RIBOSOMES WITH α -FLAG BEADS.
- 3) SUBSEQUENT ANALYSES: RNA-SEQ, RIBOSOME FOOTPRINTING.



Ron, Kajala *et al.*, Plant Physiol, 2014