

Genes of Arabidopsis: The  
Functions of CDKA;1  
(AT3G48750) and MYB33  
(AT5G06100)

Dominic Saadi

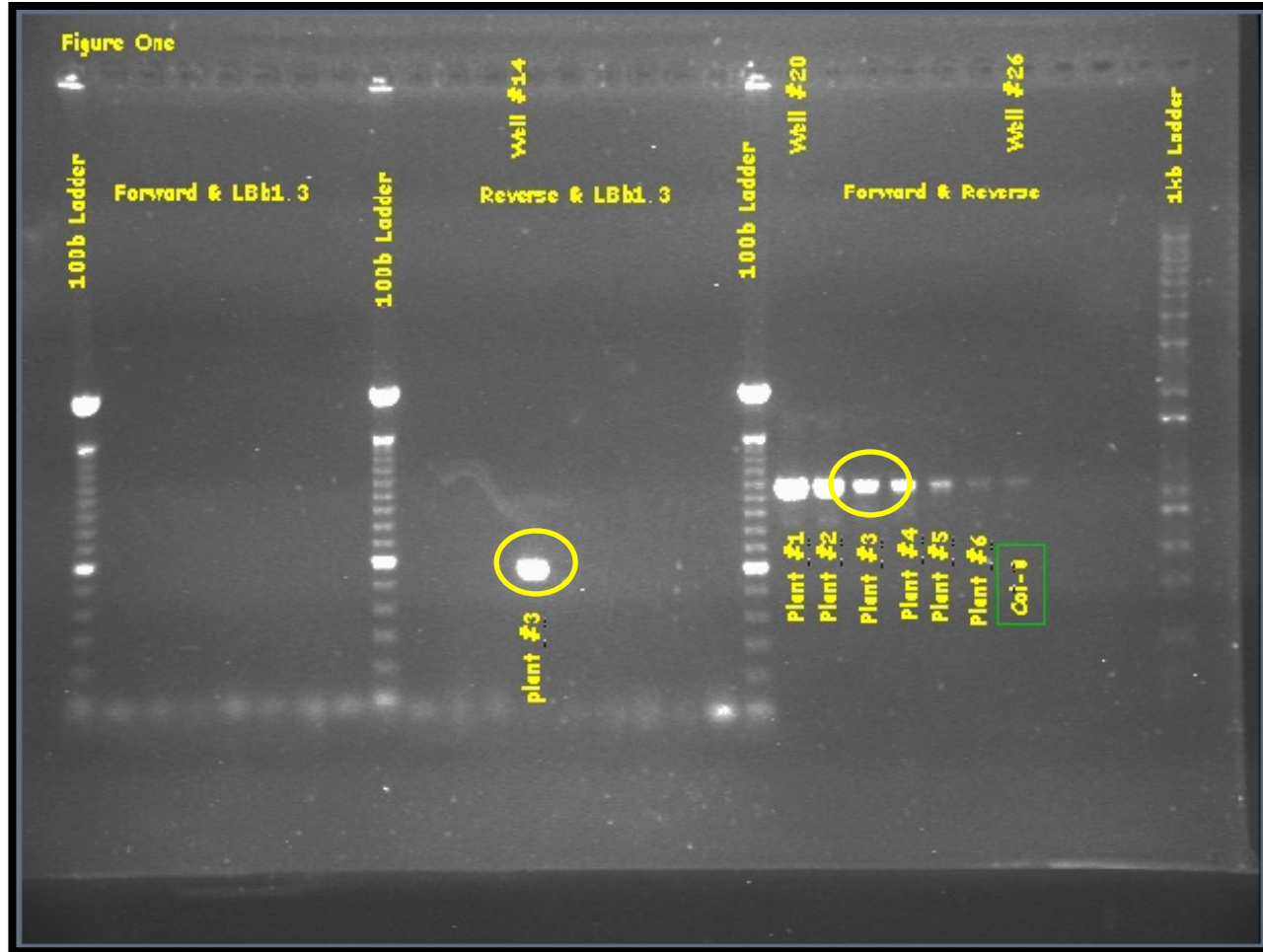
September 3, 2014

# What are the Identities and Functions of Gene F and Gene O?

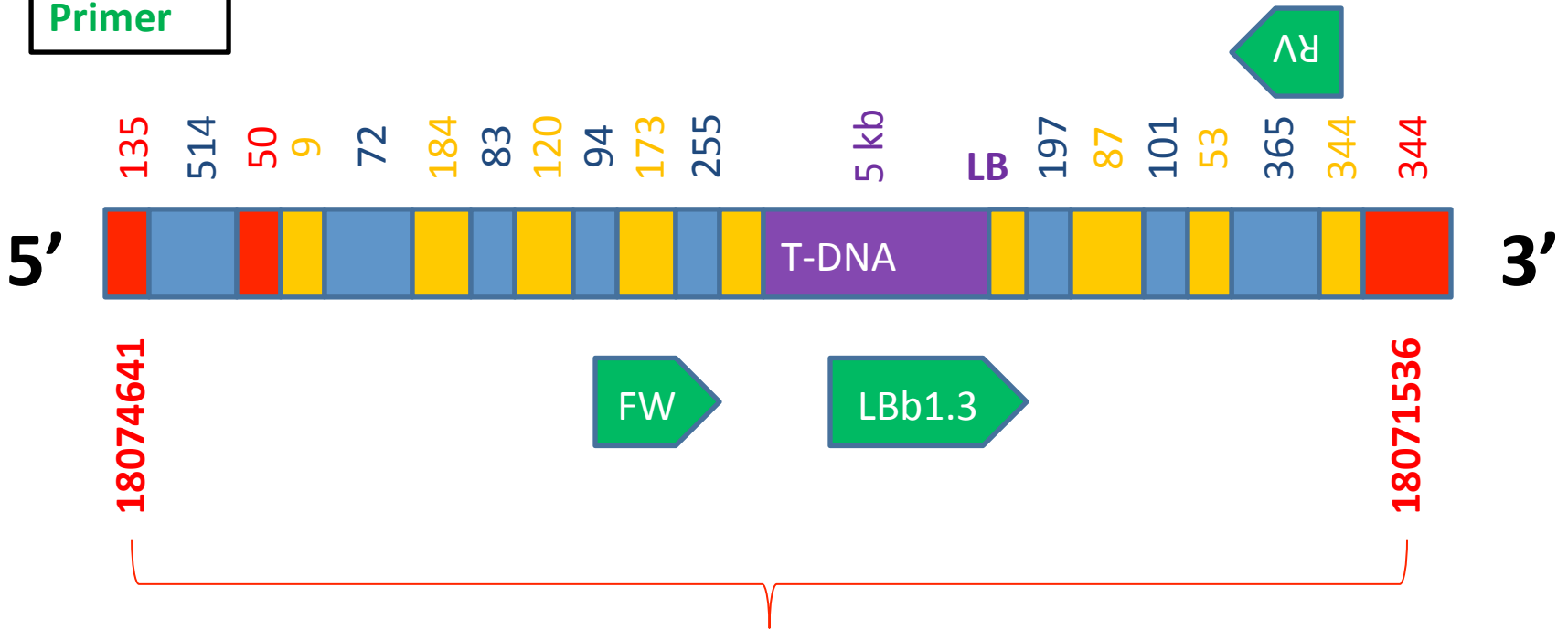
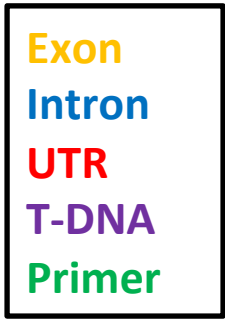
- *GOAL*: Discover the identity and function of Gene F and Gene O of Arabidopsis
- *WHY*: Agricultural challenges: Crop yields have to be increased.
  - Identify genes and processes that will help increase crop yields and food production.
- *RESULTS*
  - Gene F - AT3G48750 - CDKA;1
  - Gene O - AT5G06100 - MYB33

**CDKA;1: AT3G48750**

# Plant Three is Heterozygous for a T-DNA Insertion



# Cartoon of AT3G48750

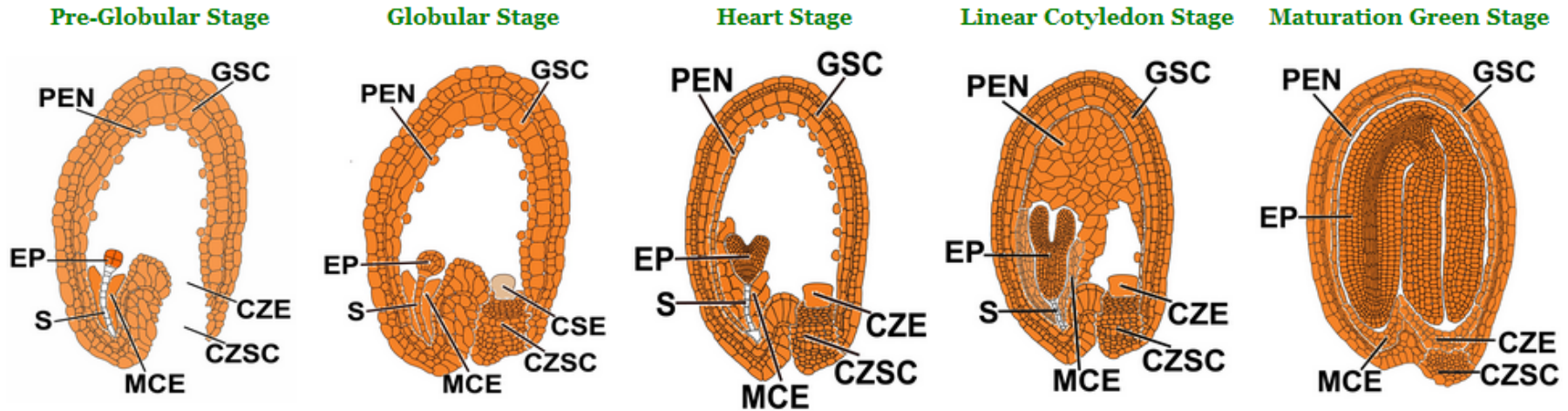


**Total Length: 3105 bp**

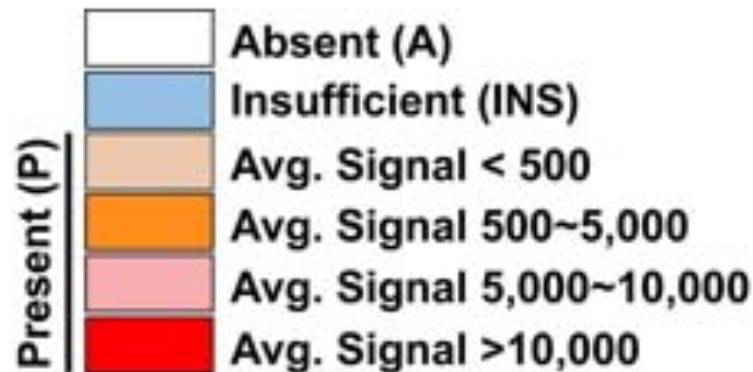
**8 Exons, 8 Introns**

**Protein is 294 Amino Acids Long**

# AT3G48750 Expresses at a Constant Rate During All Stages of Development



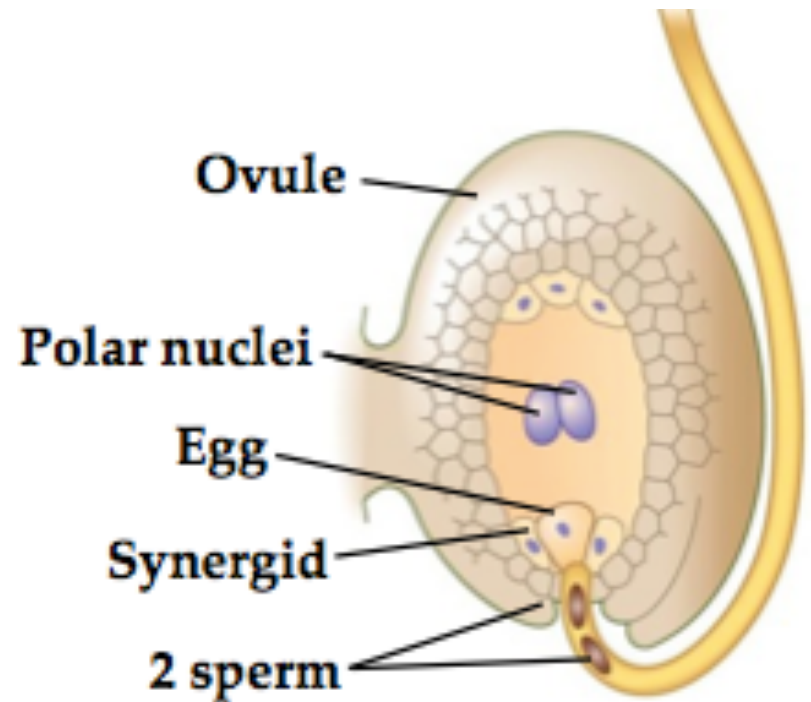
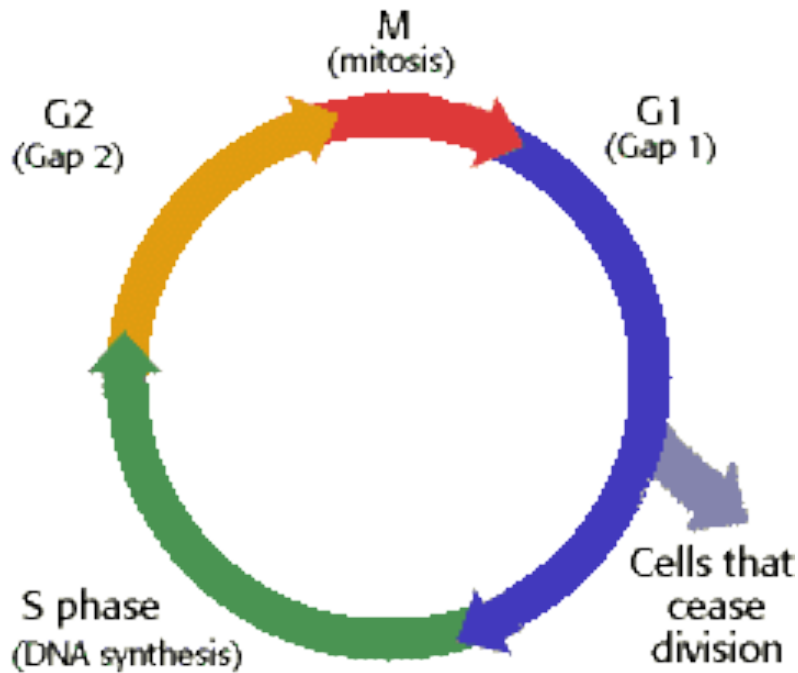
CZE – Chalazal Endosperm  
 CZSC – Chalazal Seed Coat  
 EP – Embryo Proper  
 GSC – General Seed Coat  
 MCE – Micropylar Endosperm  
 PEN – Peripheral Endosperm  
 S - Suspensor



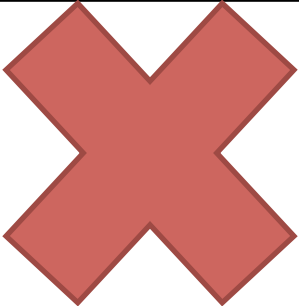
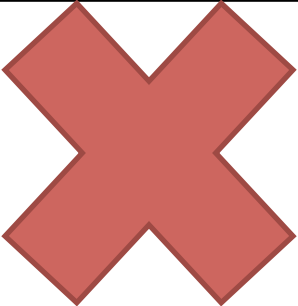
# Loss of CDKA;1 Activity Disallows the Mitotic Division of the Generative Cell

CDKs Control the Cell Cycle

Cyclin Activates CDK



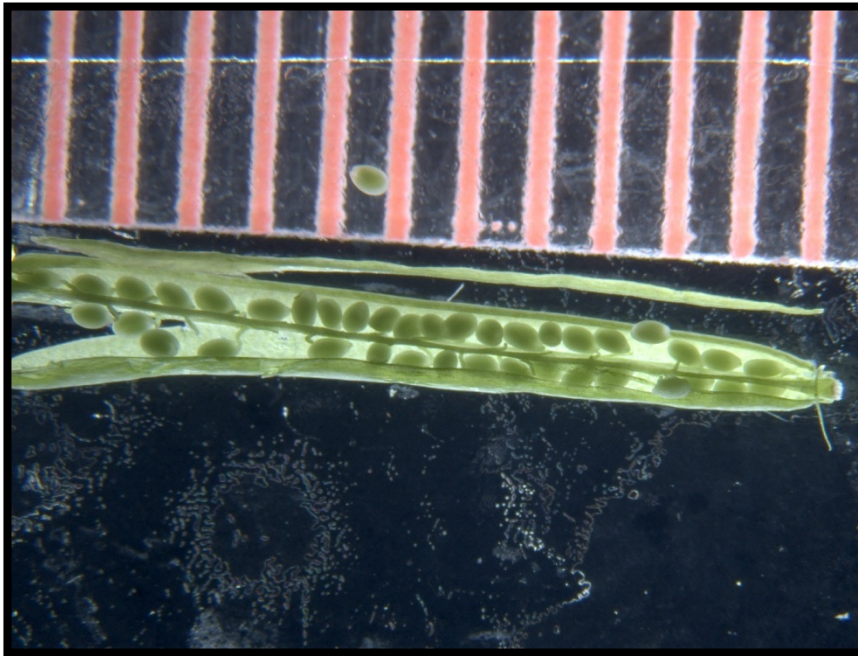
# Punnett Square Predicts 50% of Seeds Will Die Prior to Embryogenesis

		Female Gametes	
		WT+	WT-
Male Gametes	WT+	WT+WT+	WT+WT-
	WT-	WT-WT+ 	WT-WT- 



# Silique Dissection Reveals a Mutant Phenotype: Missing Seeds

Dissection of a Wild Type Silique Shows Many Seeds



Dissection of a Mutant Silique Shows Half of the Seeds Missing



# A Chi Squared Test Does Not Allow Rejection of the Null Hypothesis

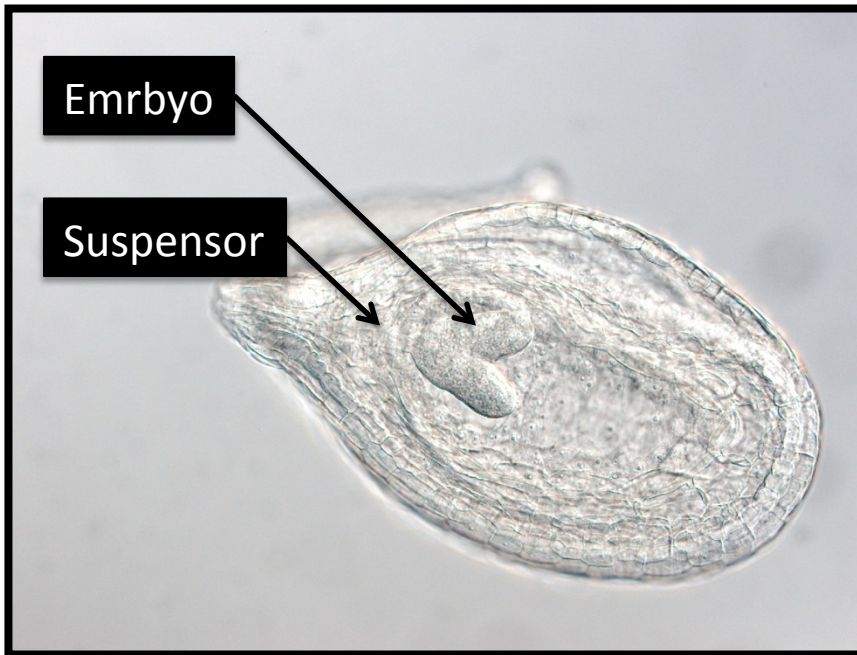
$$\chi^2 = \sum \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$$

**Null Hypothesis: Variation from the Expected Result is Due to Chance and Chance Alone**

- **Observed: 19**
- **Expected: 21**
  - **P-Value > 50%**

# NIC Shows Normal Seeds Within Mutant Siliques

An Embryo from a Mutant Silique in the Torpedo Stage



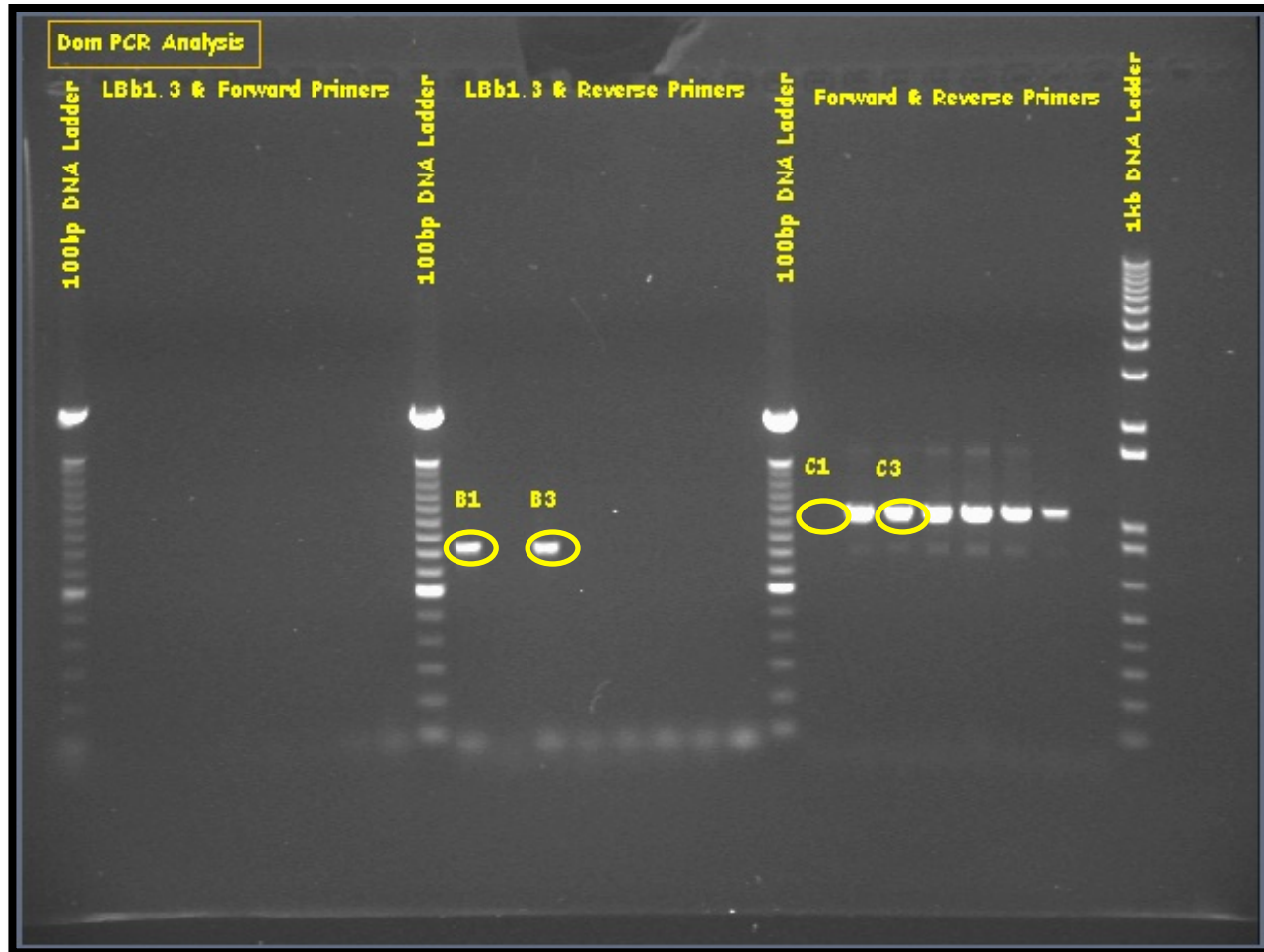
Funiculi From Siliques of Mutant Plants Lacking Seeds



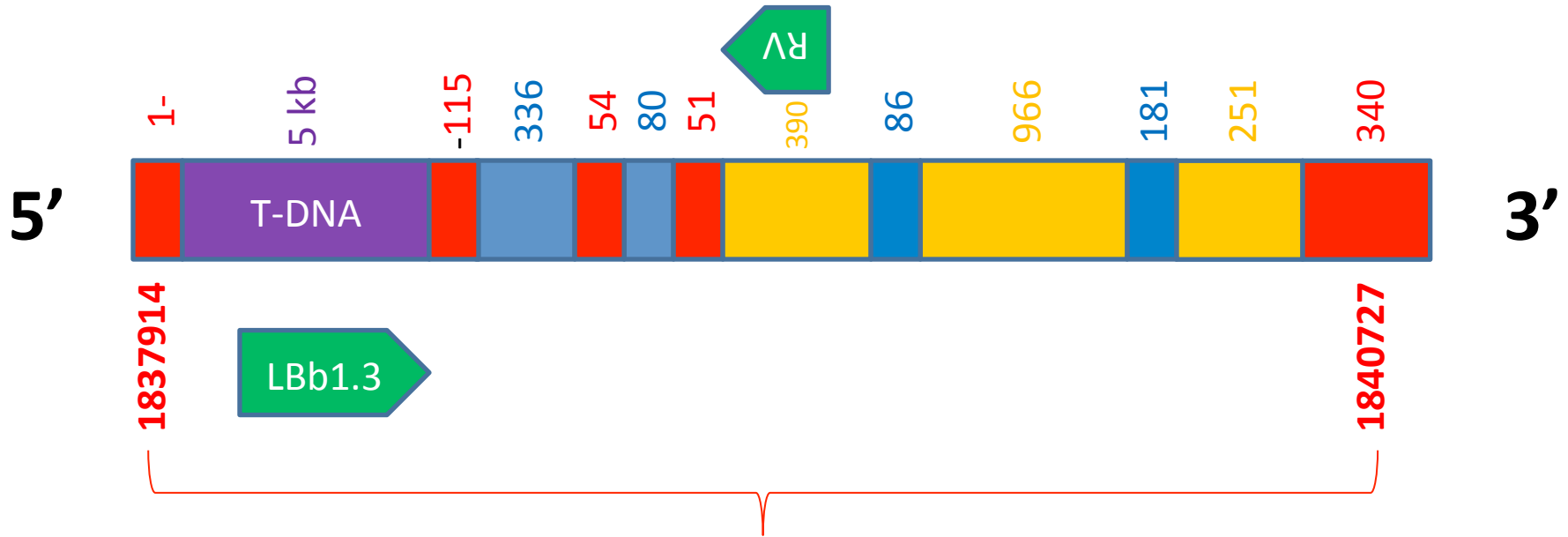
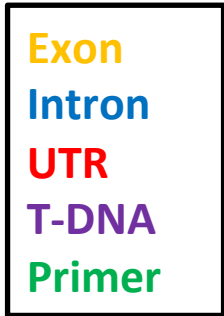
**MYB33: AT5G06100**



Plant One is Homozygous for the T-DNA Insertion; Plant Three is Heterozygous



# Cartoon of AT5G06100

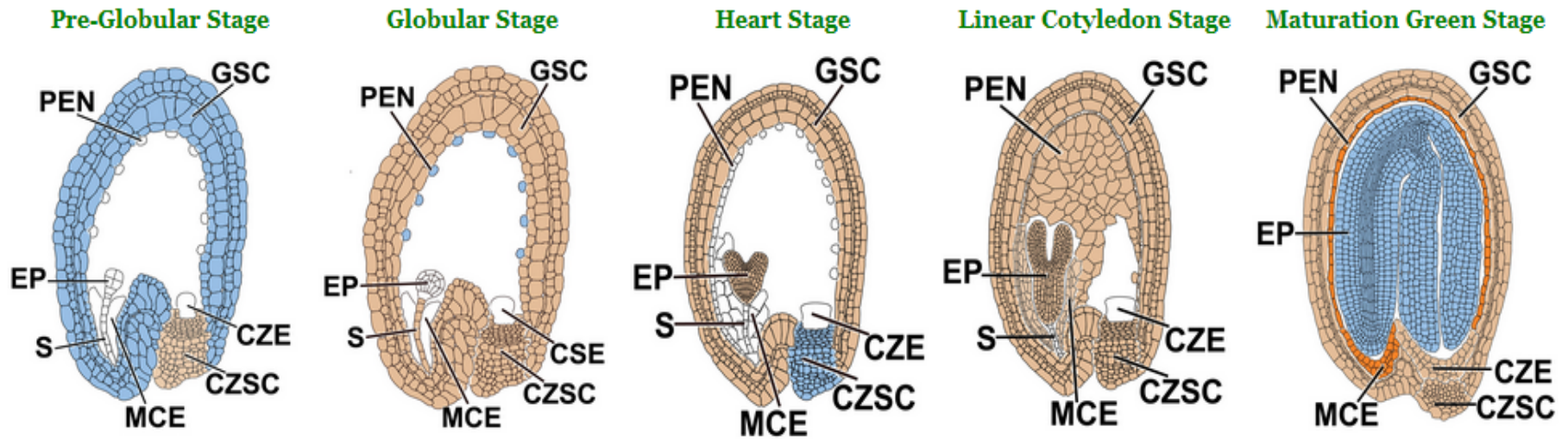


**Total Length: 2813bp**

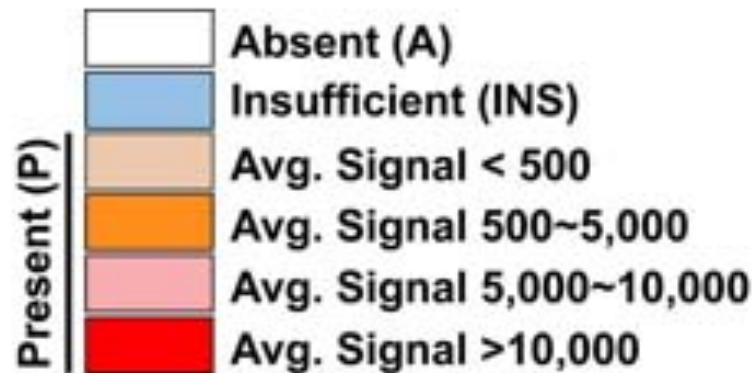
**3 Exons, 4 Introns**

**Protein is 520 Amino Acids Long**

# AT5G06100 Expression is Low During the Heart and Torpedo Stages

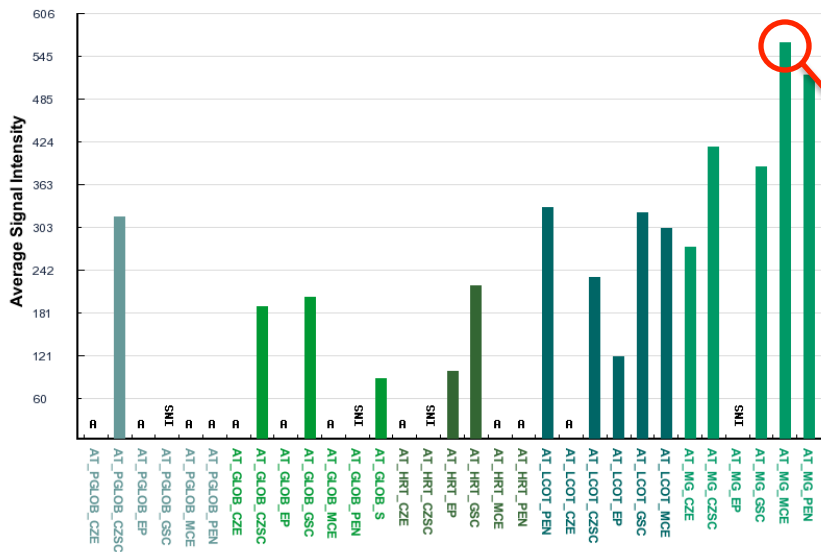


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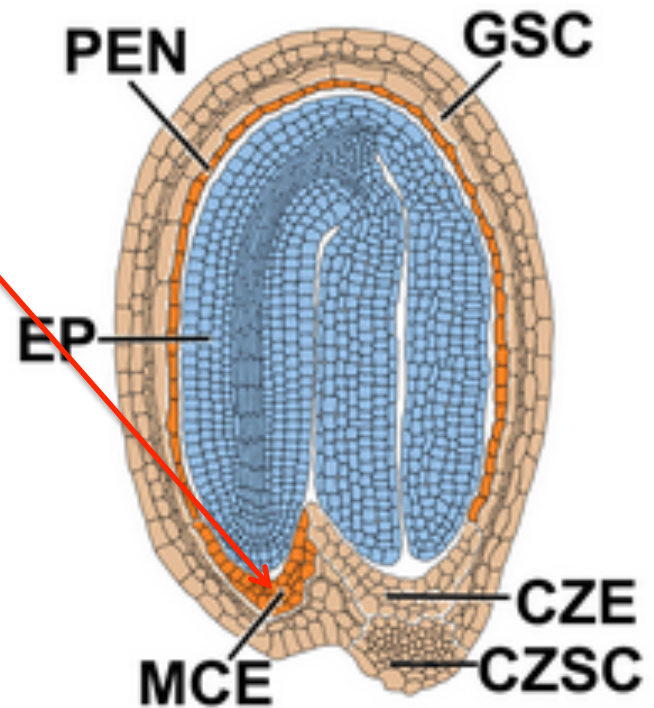


# The Greatest Expression Occurs in the Mature Green Micropylar Endosperm

Maturation Green Stage



GeneChip Experiments (Organized by Stage and Tissue/Compartment)



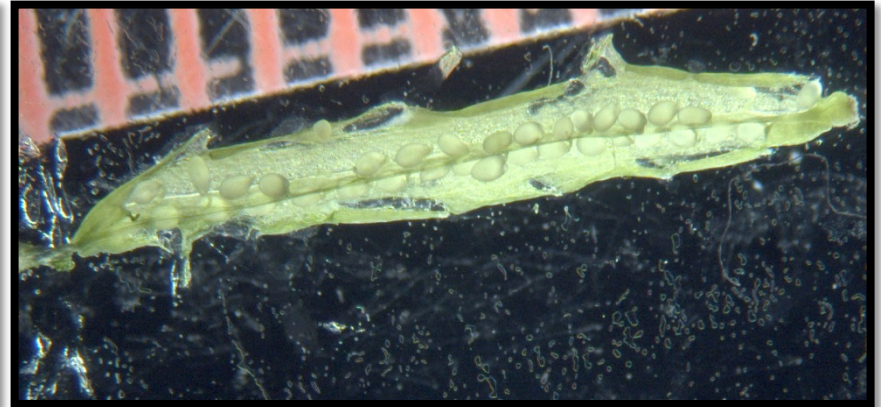
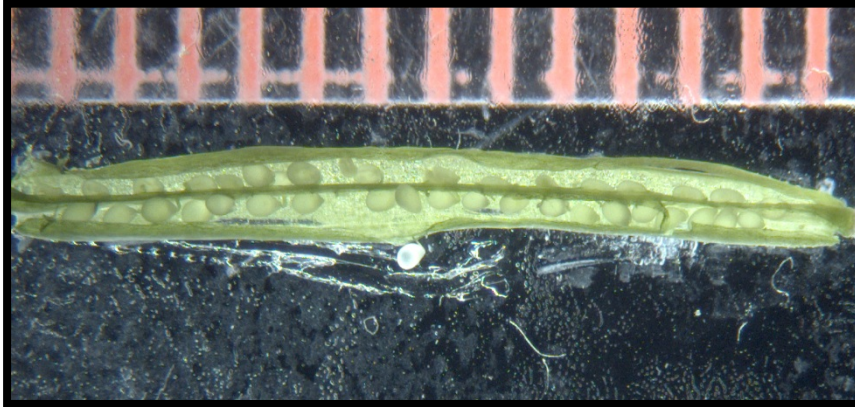


# Silique Dissection Reveals No Observable Mutant Phenotype

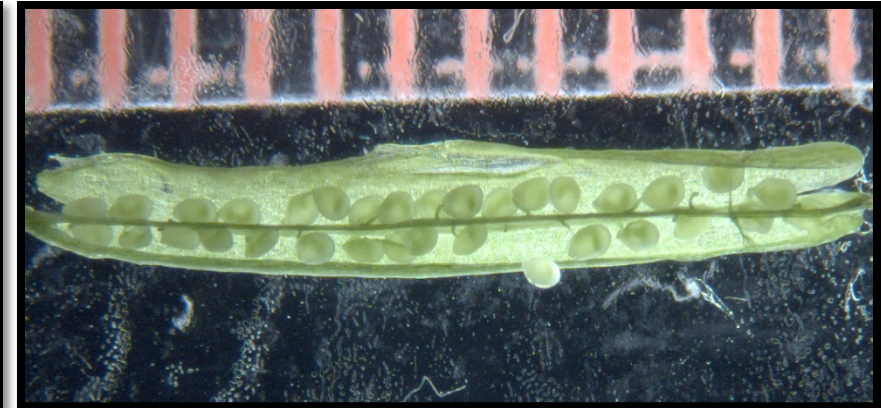
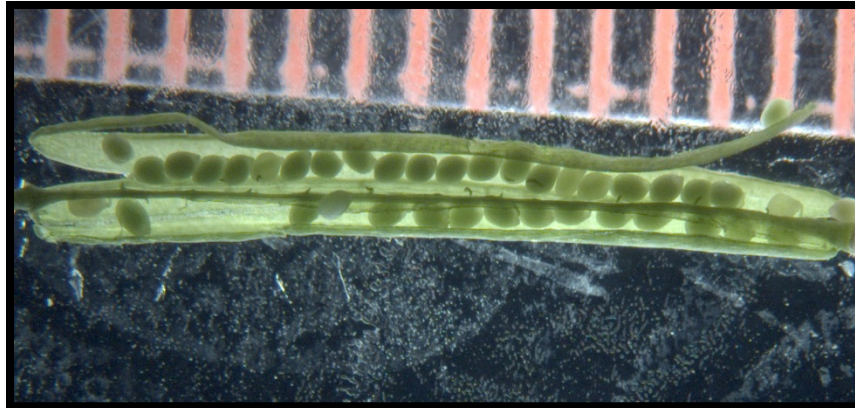
Mutant Seeds

Wild Type Seeds

Early Development

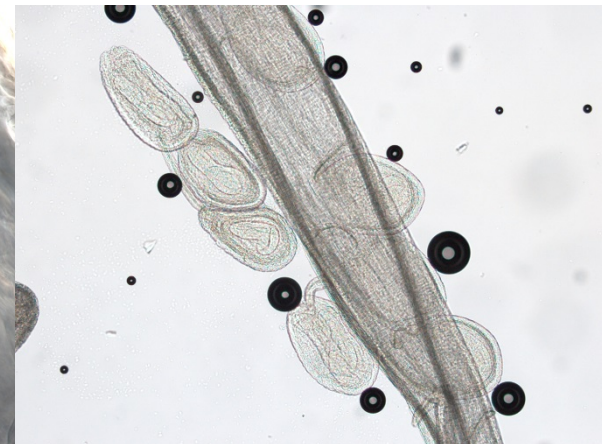


Late Development





# NIC Shows Seeds Developing Normally Within a Silique Homozygous for the T-DNA Insertion

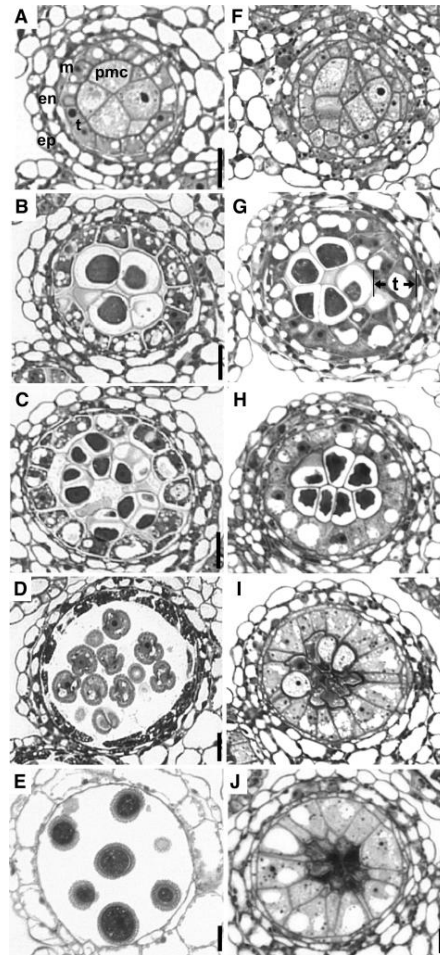


# MYB65 has a Function Similar to MYB33 and Compensates for the Loss of MYB33

- “neither single mutant phenotype displayed a phenotype implying that MYB33 and MYB65 are functionally redundant”
  - Overall 58.4% identical at the amino acid level, but >90% identity shared between their R2R3 Domains
  - “Analysis of their chromosomal locations reveal they lie within segmental duplicated regions of the Arabidopsis genome”
  - “...they have similar expression patterns”

# “Comparison of the Development of Locules from WT and myb33 myb65 Plants”

Development in  
WT Anthers (A-E)



At the PMC Stage  
The tapetum enlarges

The tapetum continues to expand  
The PMCS begins to degrade

# Future Experiments

- Questions Still Exist About MYB33's Function
  - Exactly what genes does it regulate?
  - Exactly what biological processes does it regulate?
- Measure Differences in mRNAs after knocking out MYB33 & MYB65.
- Examine MYB33 Binding Domain