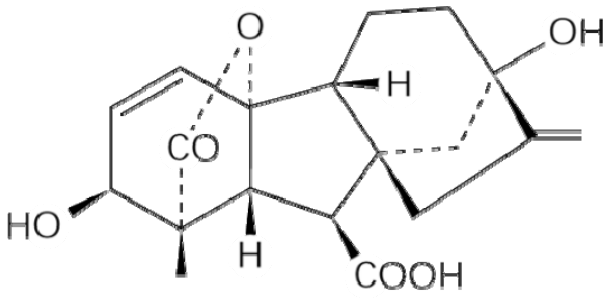
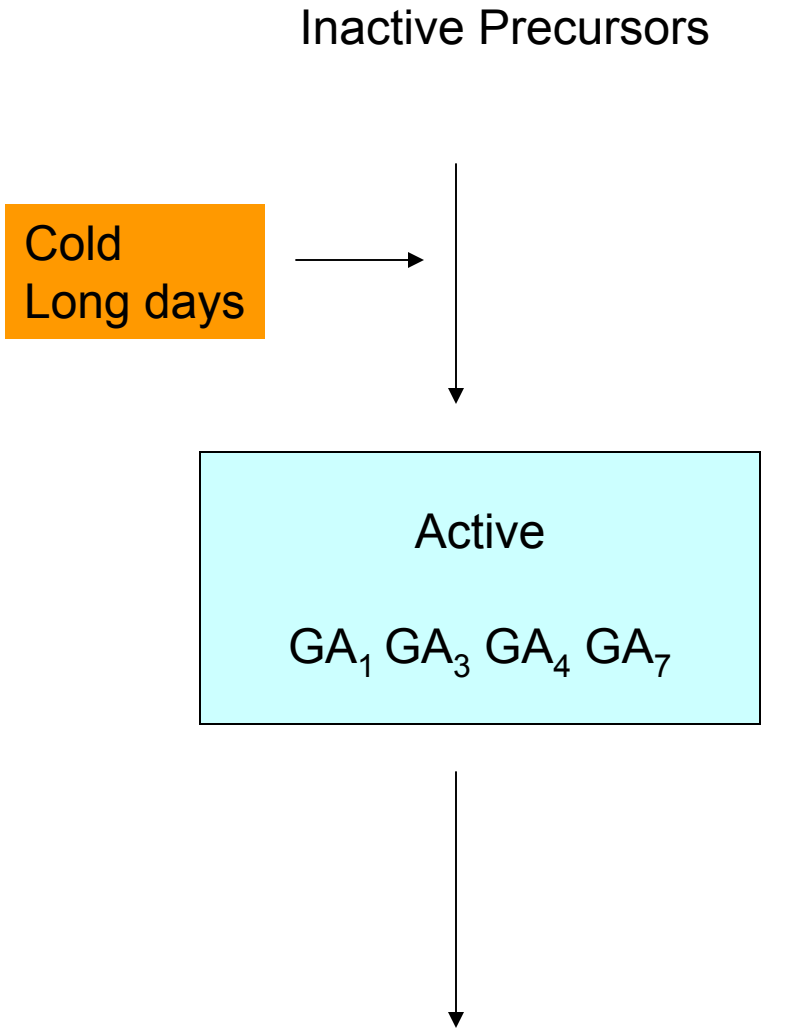
# Gibberellins

**Wheat infected by the fungus** *Gibberella fujikuroi* → **isolation of Gibberellin**




$GA_3$ (Gibberellic acid)

There are more than 120 different  Gibberellin molecules in a plant
Most of them are inactive precursors or catabolic products


Inactive Precursors
Cold
Long days
Active
$GA_1$ $GA_3$ $GA_4$ $GA_7$
Catabolic inactive products

Effects of Gibberellins:

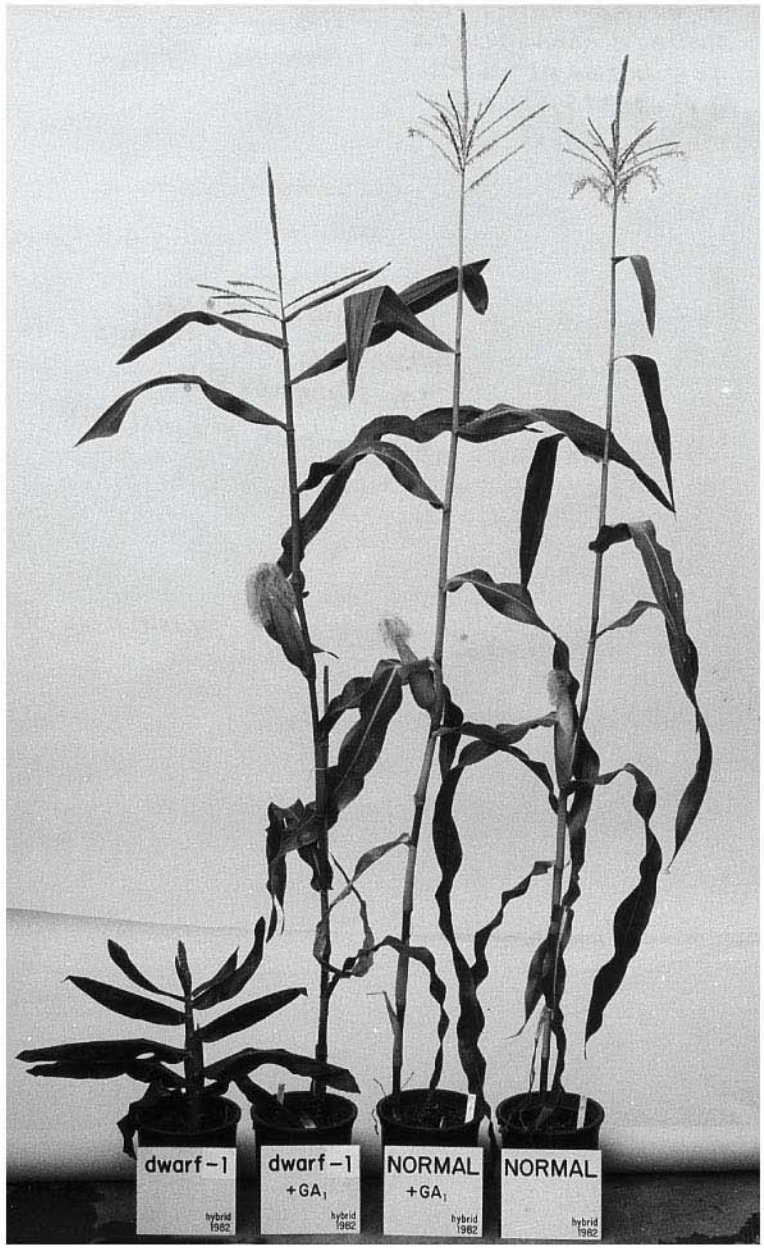
**1- stimulate stem growth**

**2- transition from juvenile to adult phases (flowering)**

**3- seed germination**

## 1- stimulate stem growth

Mendel’s dwarf pea is due to the block of Gibberellin biosynthetic pathway




***PLANT PHYSIOLOGY, Fourth Edition,* Figure 20.1** 

# GA stimulates both cell elongation and cell division (mitosis)

**Cell elongation**:
Like auxin, GA modifies of Y, the wall yield threshold

$$dV/dt = m (P-Y)$$

but not via acidification of the cell wall
GA uses other enzymatic way to modify wall (penetration of expansin)

**Cell division**:
GA promotes the transition from G1 to S phase and to G2 to M of the cell cycle → mitosis

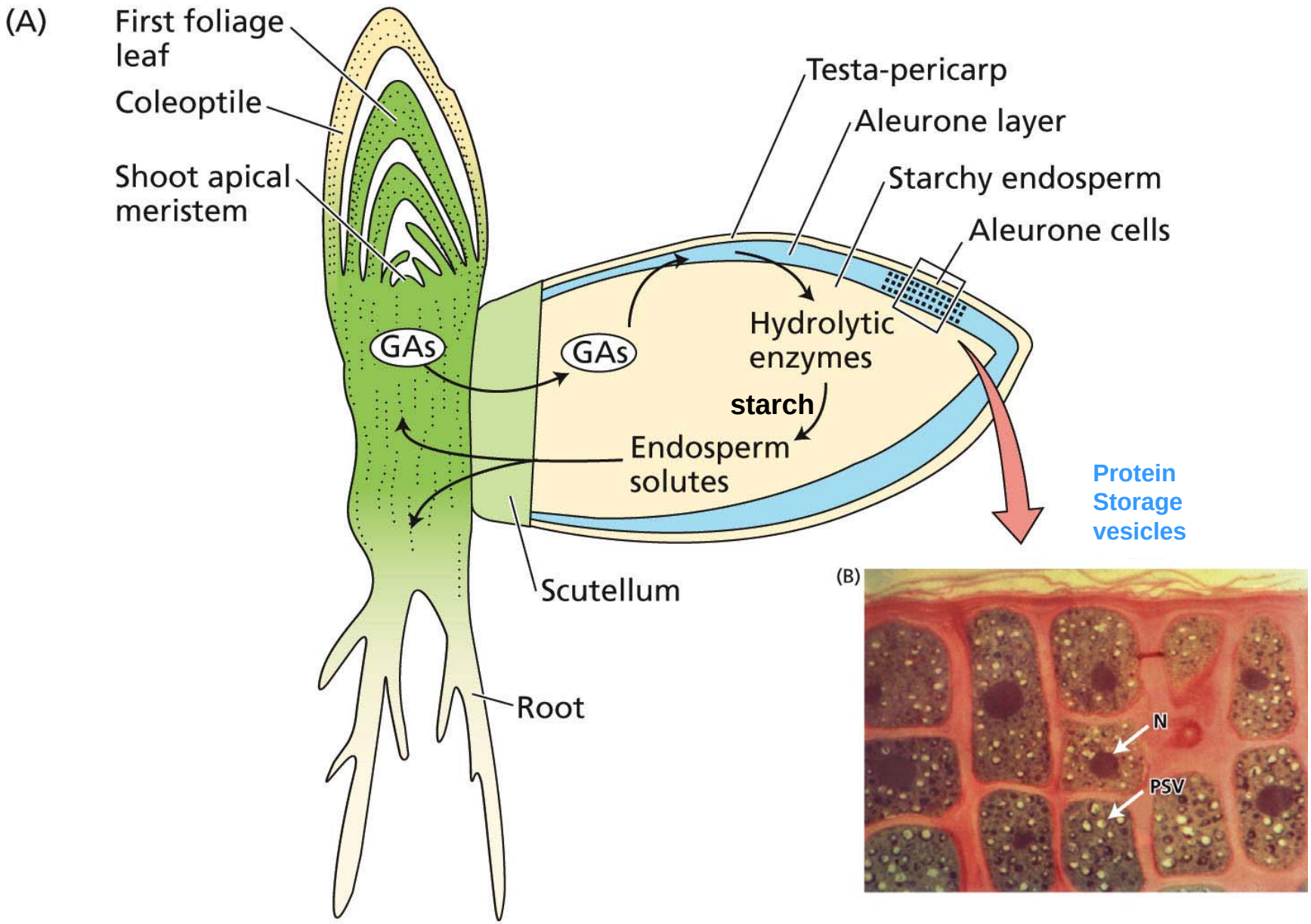
Synthesis of CDKs, cyclin-dependent protein kinases

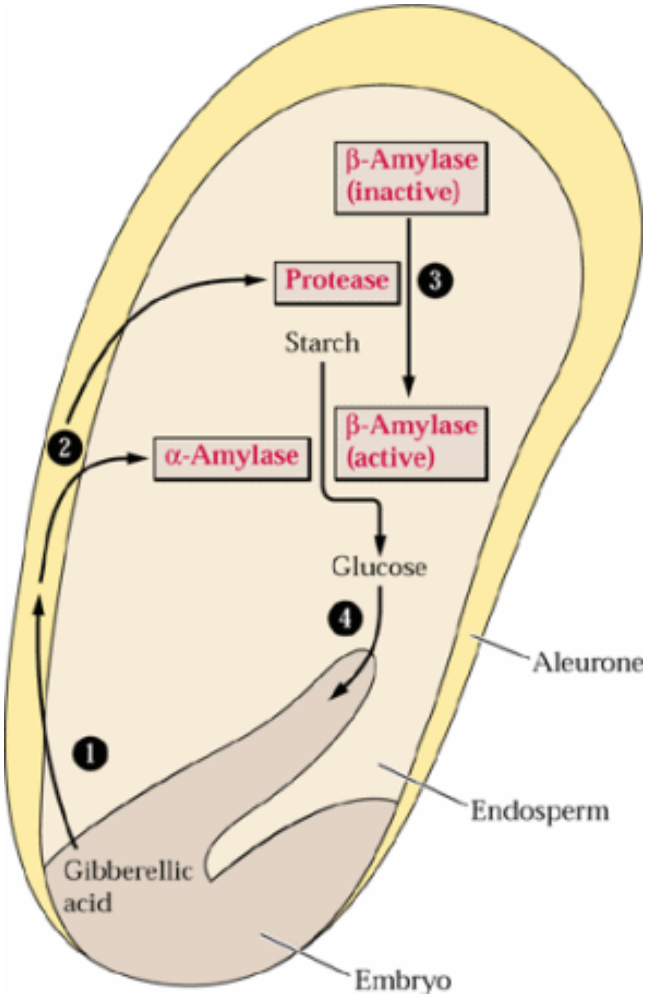
## 2- transition from juvenile to adult phase

- In conifers juvenile phase may last 20 years

Cabbage, a long-day plant
remains as a rosette in short days
but it can be induced to flower
by application of $GA_3$.
(In this case, giant flowering stalks
were produced)

# 3- seed germination

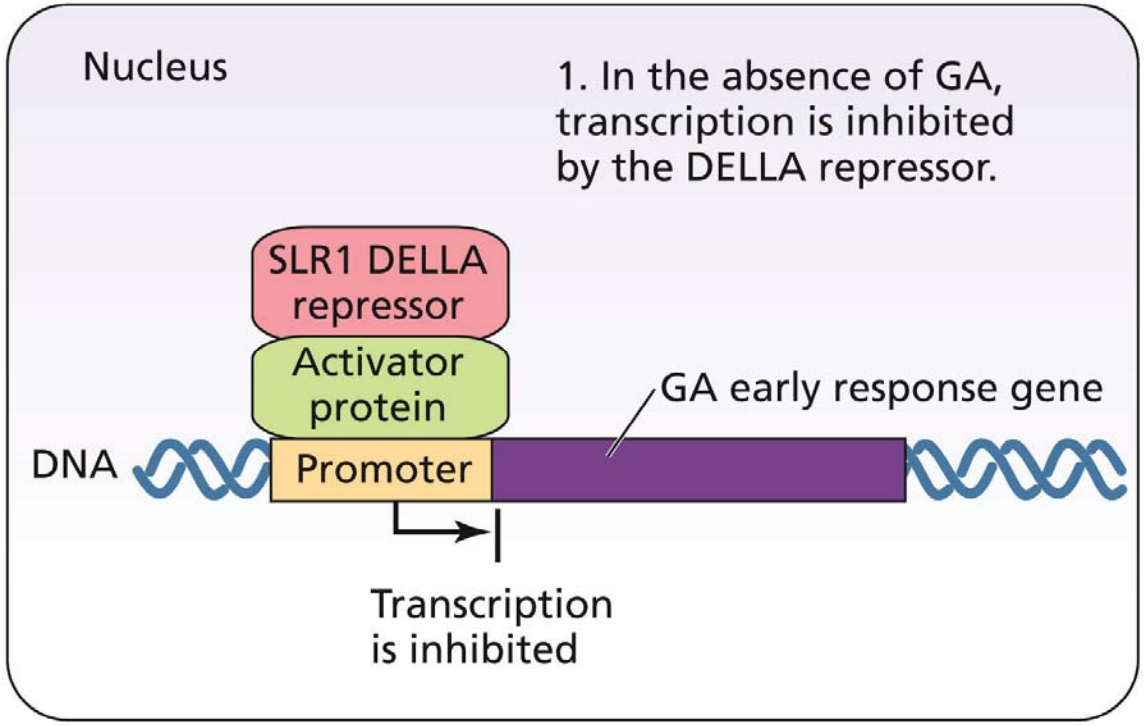



β-Amylase
(inactive)
Protease
3
Starch
β-Amylase
(active)
2
α-Amylase
Glucose
4
Aleurone
1
Endosperm
Gibberellic
acid
Embryo

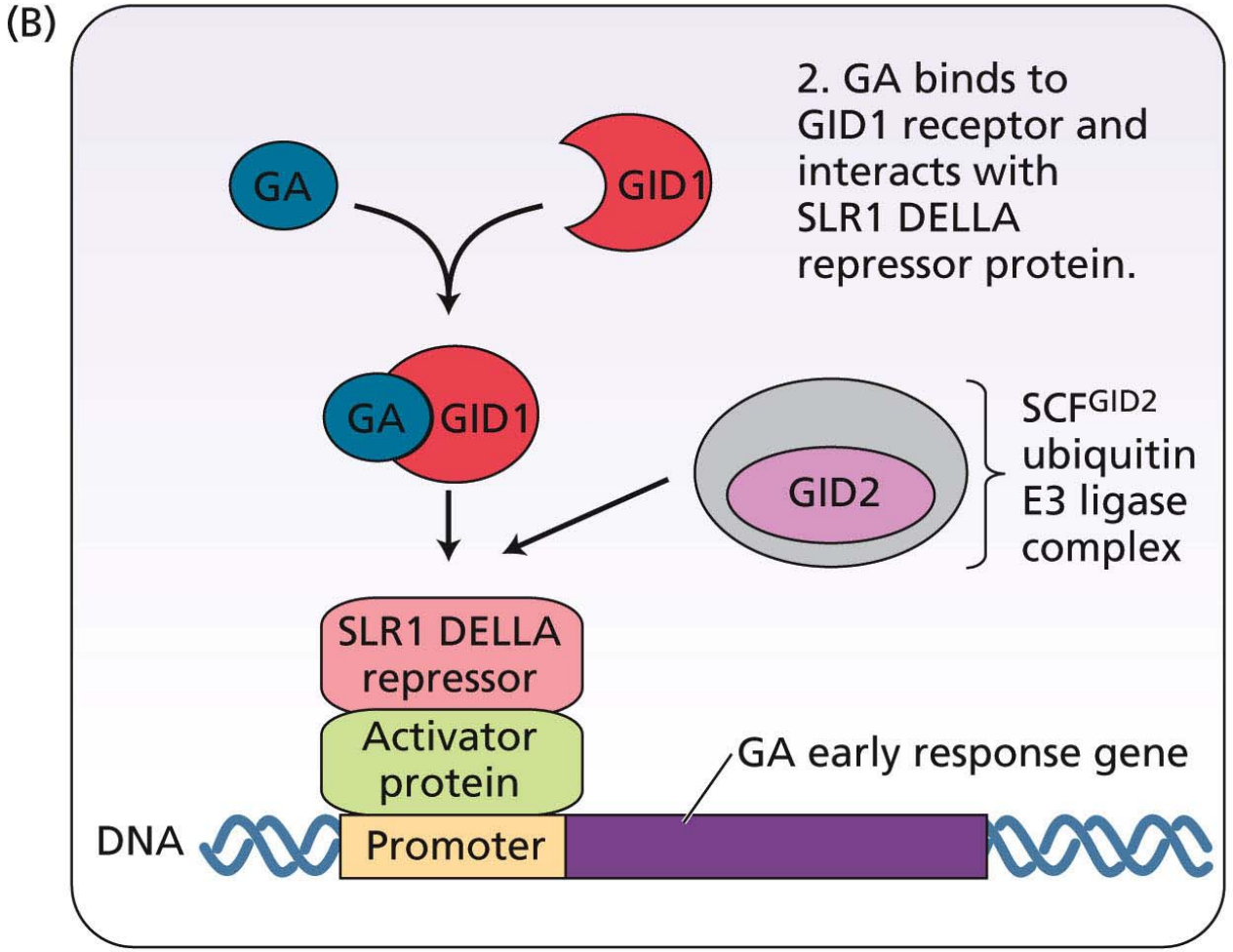
# Gibberellin Signal perception

Model of GA binding to its receptor and subsequent activation of gene expression

(A)

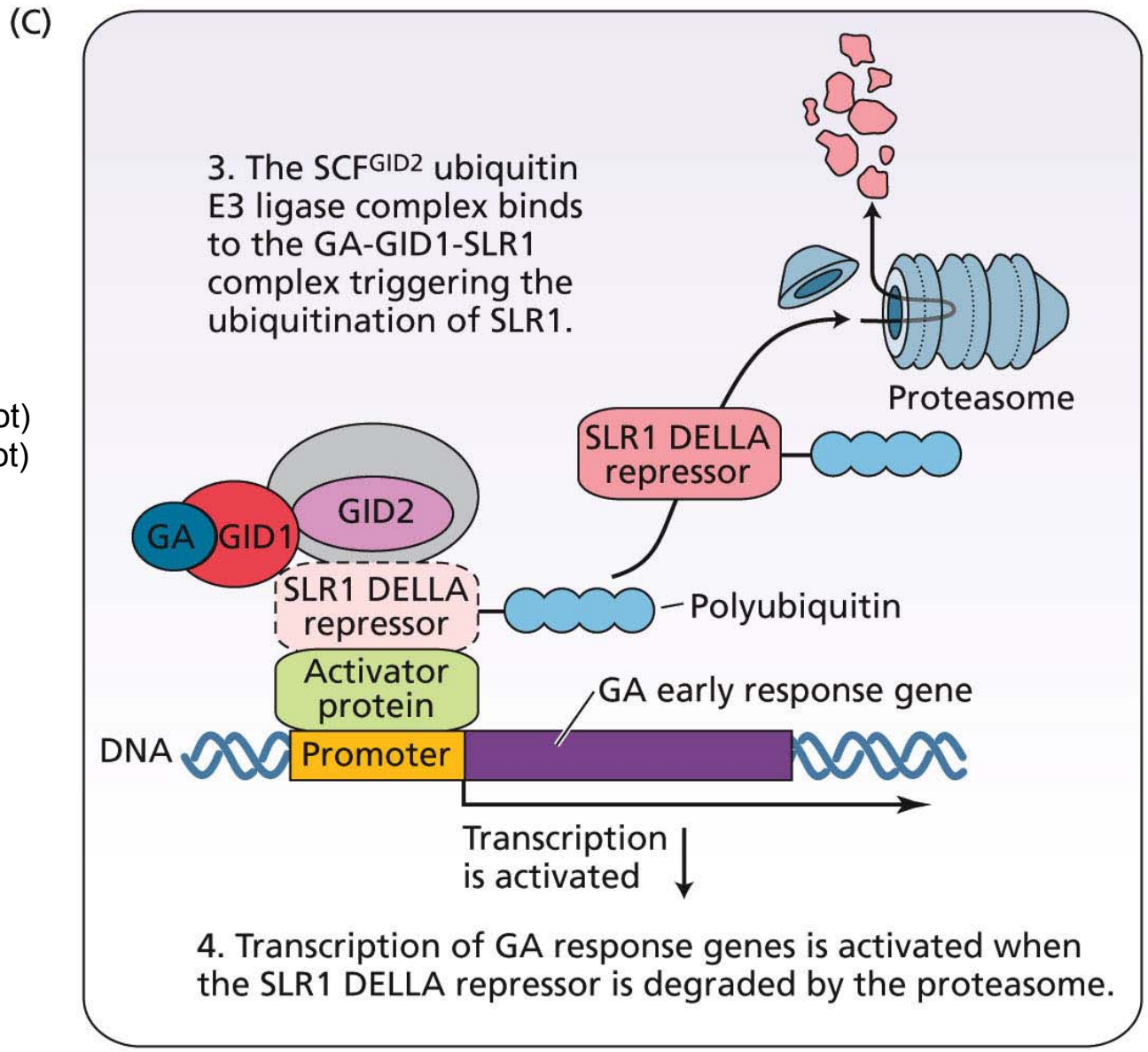



*PLANT PHYSIOLOGY, Fourth Edition,* **Figure 20.20 (Part 1)** 

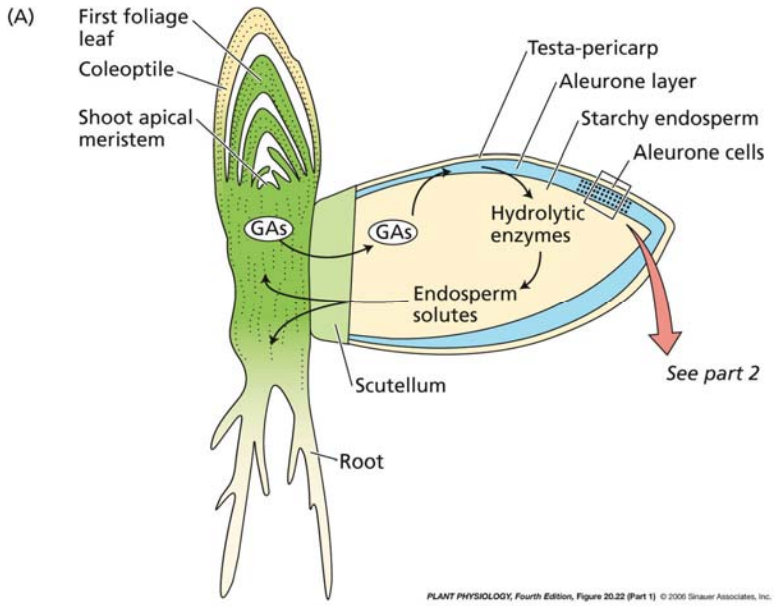



*PLANT PHYSIOLOGY, Fourth Edition,* **Figure 20.20 (Part 2)** 

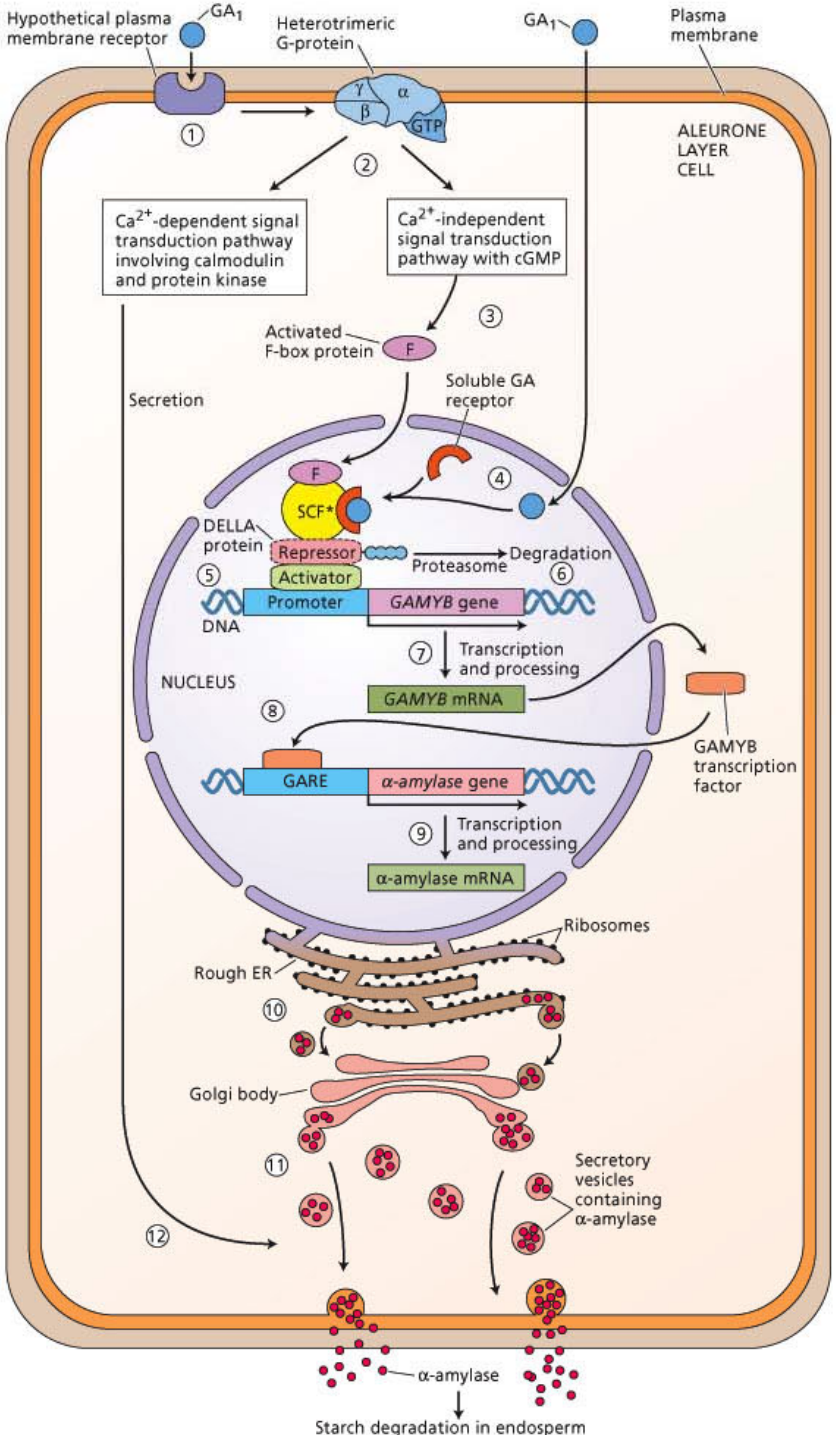
GID2 riso (monocot)
SLY1 A. Thal (dicot)



# GA signal transduction pathway in the cereal aleurone layer

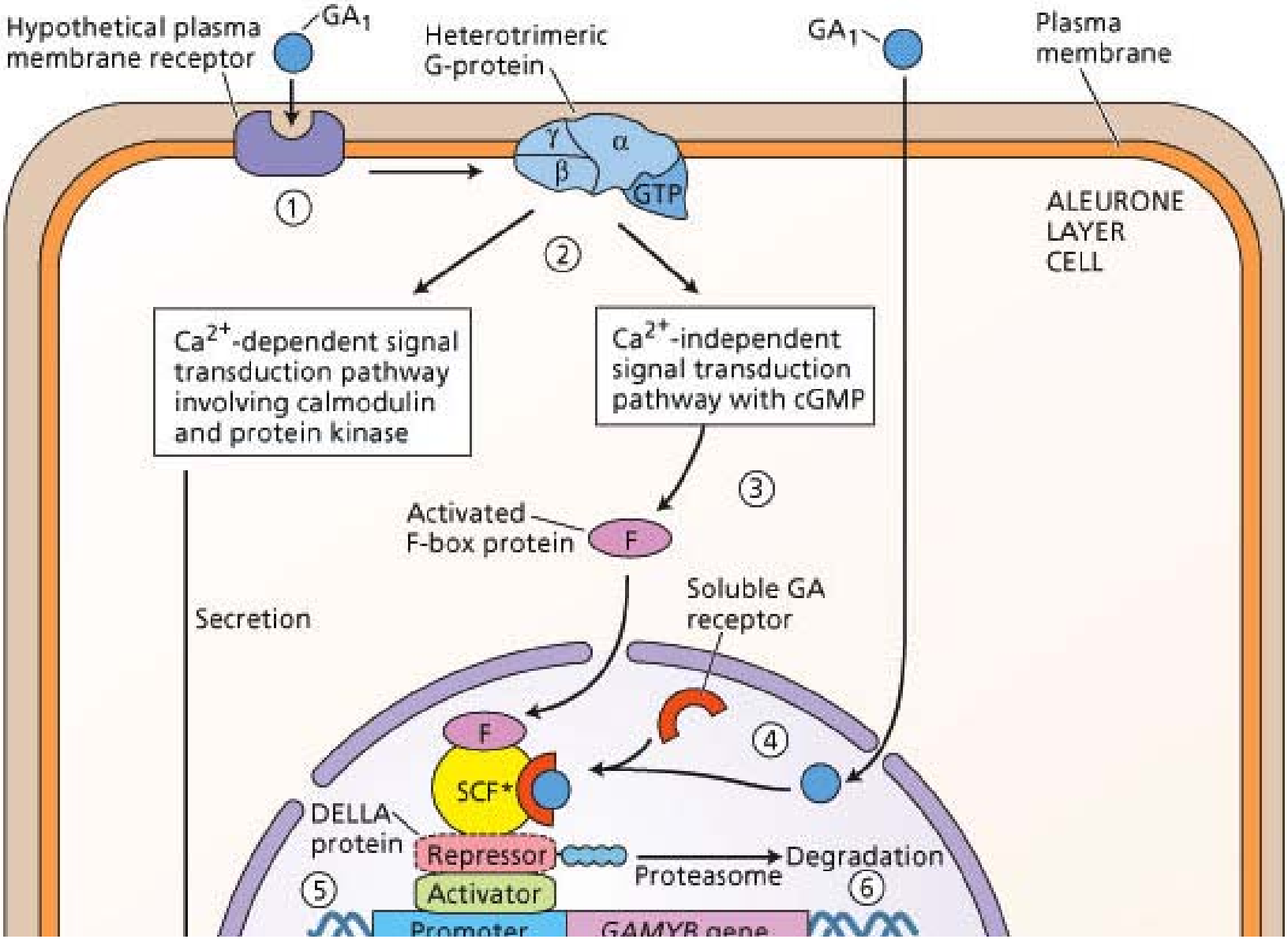


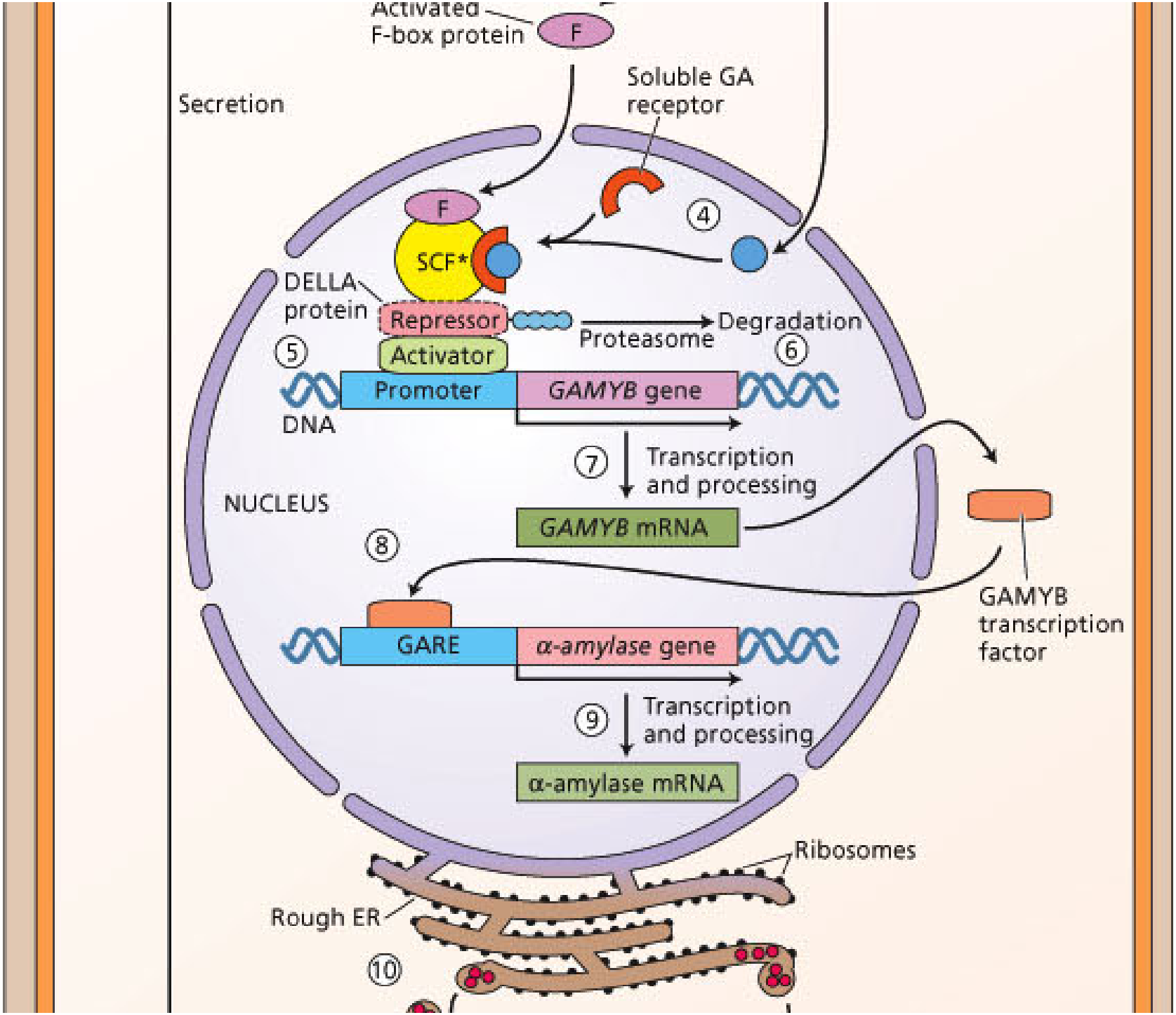
Aleurone cell



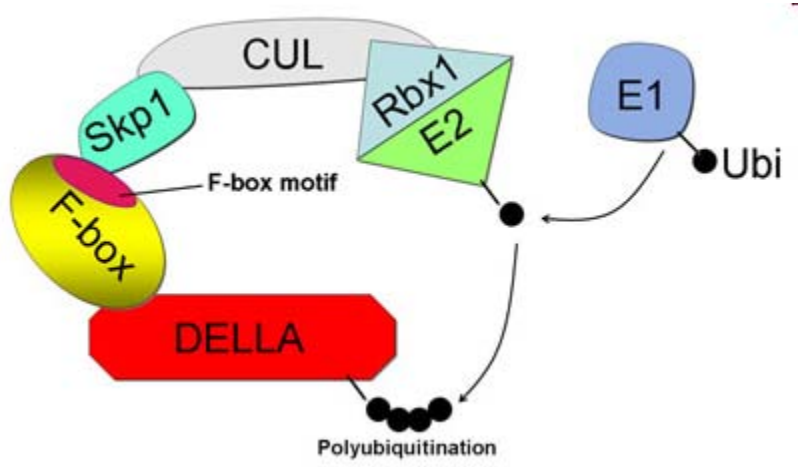
- Two receptors are possible: one at the PM and one soluble (like for ABA)

- Two events: one is $Ca^{2+}$-dependent and the other is $Ca^{2+}$-independent

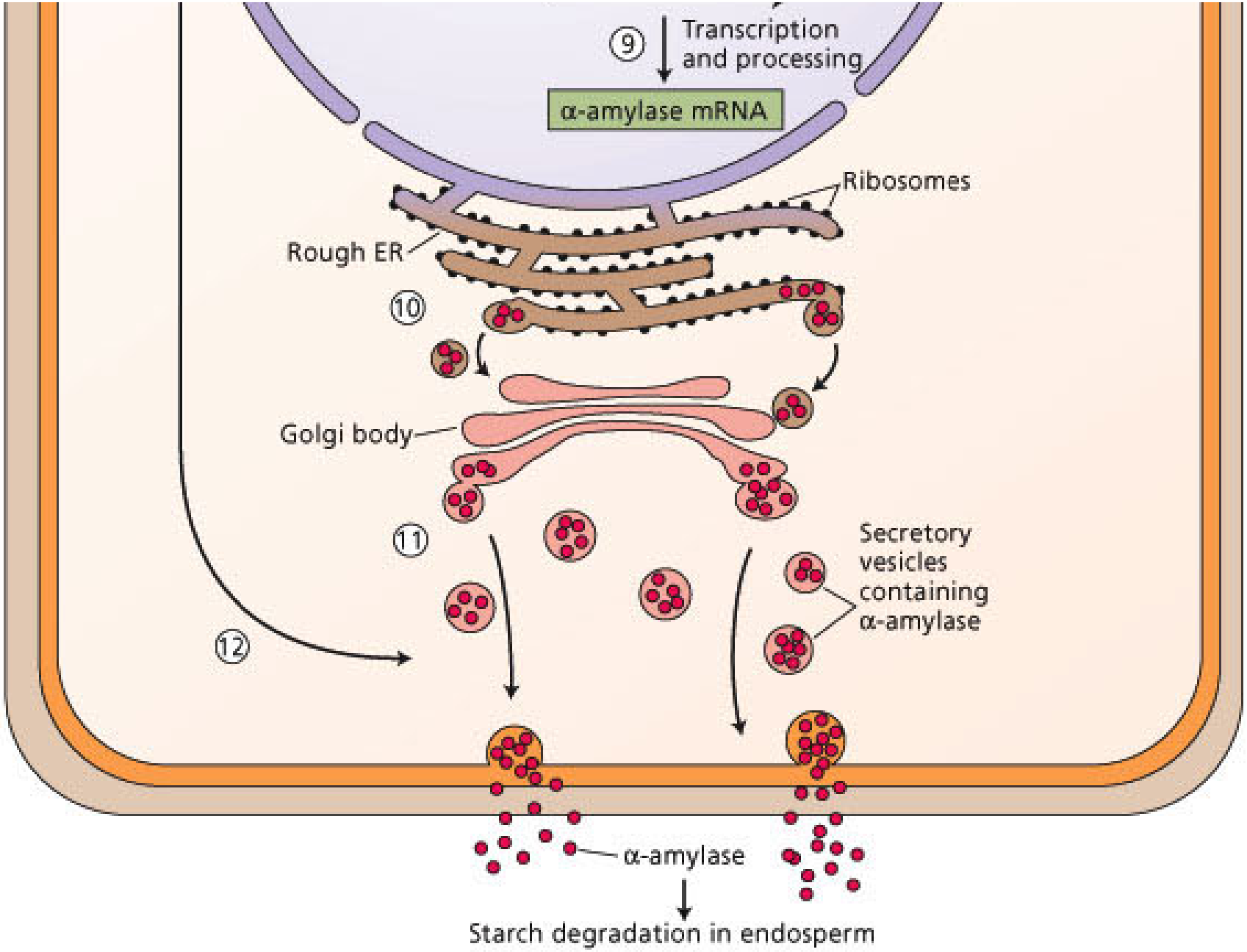

Hypothetical plasma membrane receptor
GA1
Heterotrimeric G-protein
GA1
Plasma membrane
γ
α
β
GTP
ALEURONE LAYER CELL
1
2
Ca2+-dependent signal transduction pathway involving calmodulin and protein kinase
Ca2+-independent signal transduction pathway with cGMP
3
Activated F-box protein
F
Secretion
Soluble GA receptor
F
4
SCF*
DELLA protein
Repressor
Activator
Proteasome
Degradation
5
6
Promoter
GAMYB gene


Activated
F-box protein
F
Soluble GA
receptor
Secretion
F
SCF*
4
DELLA
protein
Repressor
Proteasome
Degradation
5
Activator
6
Promoter
GAMYB gene
DNA
7
Transcription
and processing
NUCLEUS
GAMYB mRNA
8
GAMYB
transcription
factor
GARE
α-amylase gene
9
Transcription
and processing
α-amylase mRNA
Ribosomes
Rough ER
10

GID2/SLY1*




* Necessario per legare il complesso GID1-GA


9
Transcription
and processing
α-amylase mRNA
Ribosomes
Rough ER
10
Golgi body
11
12
Secretory
vesicles
containing
α-amylase
α-amylase
Starch degradation in endosperm

Dwarf-1 mutant in rice does not synthesizes alfa subunit of aleurone G protein and, upon GA stimulus, [Ca2+] does not raise. The α-amilase is produced but is not secreted.