HOS 4341

Mechanism of Onset and Release of Dormancy

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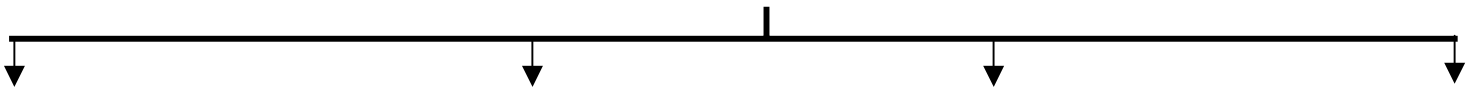


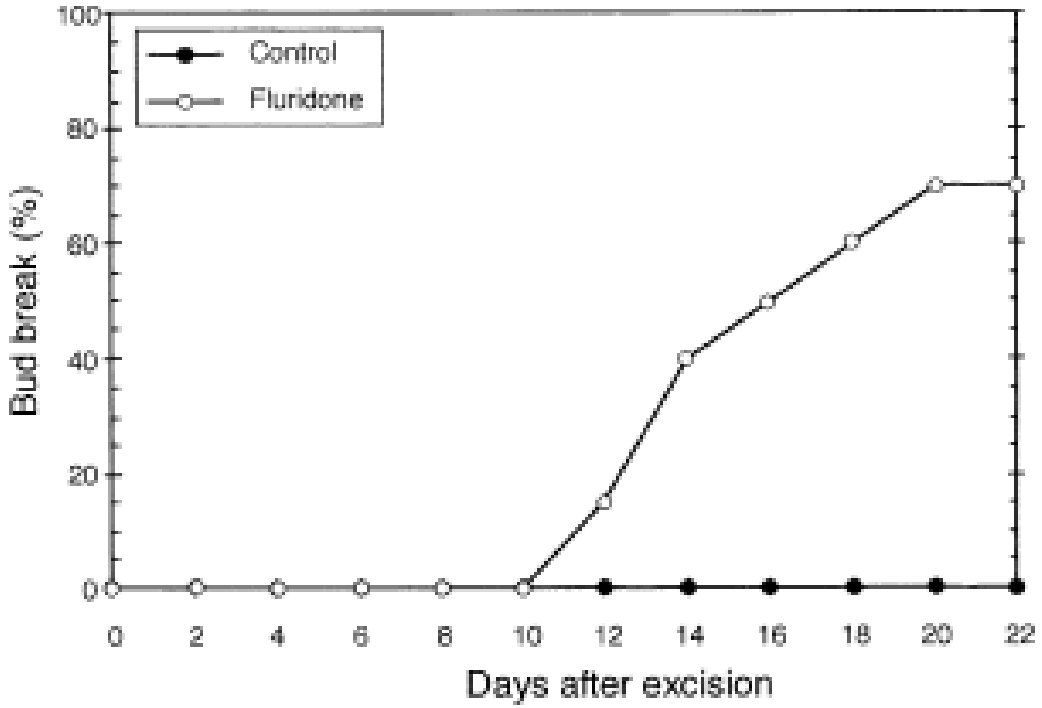
Hormonal | **Nutritional** | **Calcium** | **Gene Expression**

- **Abscisic acid**
- **Gibberellic acid**
- **Cytokinins**
- **Indole acetic acid**

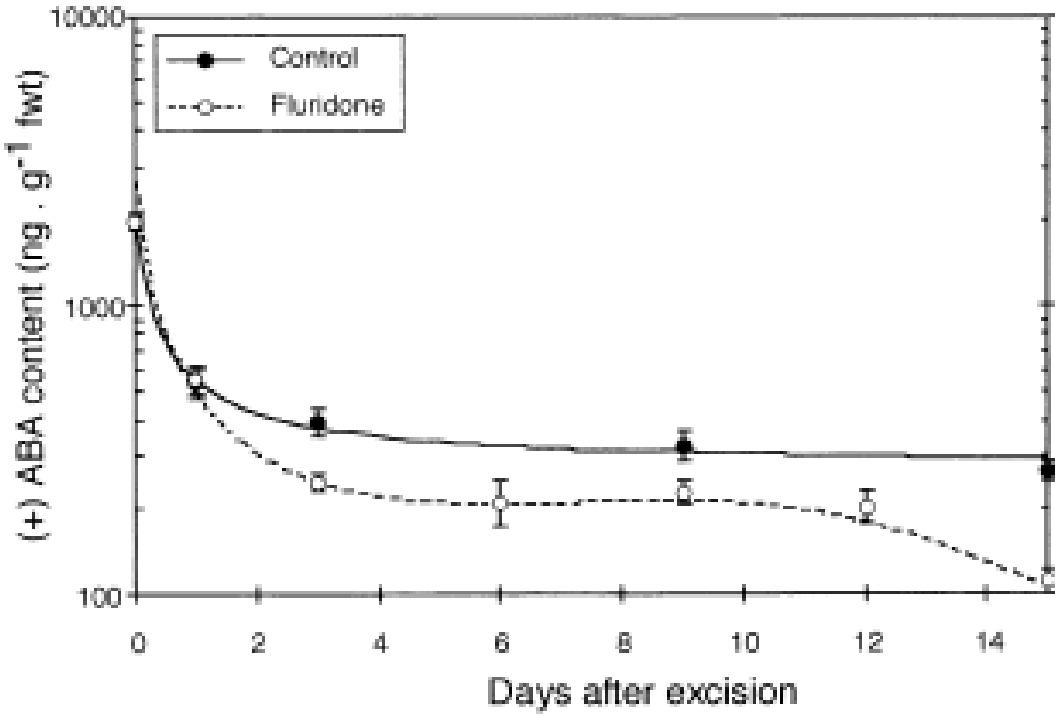
Abscisic acid

Bud dormancy in rose

A. Bud break (noted at leaflet leaf appearance) percentage of proximal axillary buds cultured *in vitro* during a 20-day period on control medium or supplemented with 50 mM fluridone (*n*=20).



B. Changes in ABA content of proximal axillary bud cultured *in vitro* on control medium or supplemented with 50 mM fluridone. Values represent the mean ± SE (*n*=8). fwt, fresh weight.



Abscisic acid – not a universal signal for bud dormancy

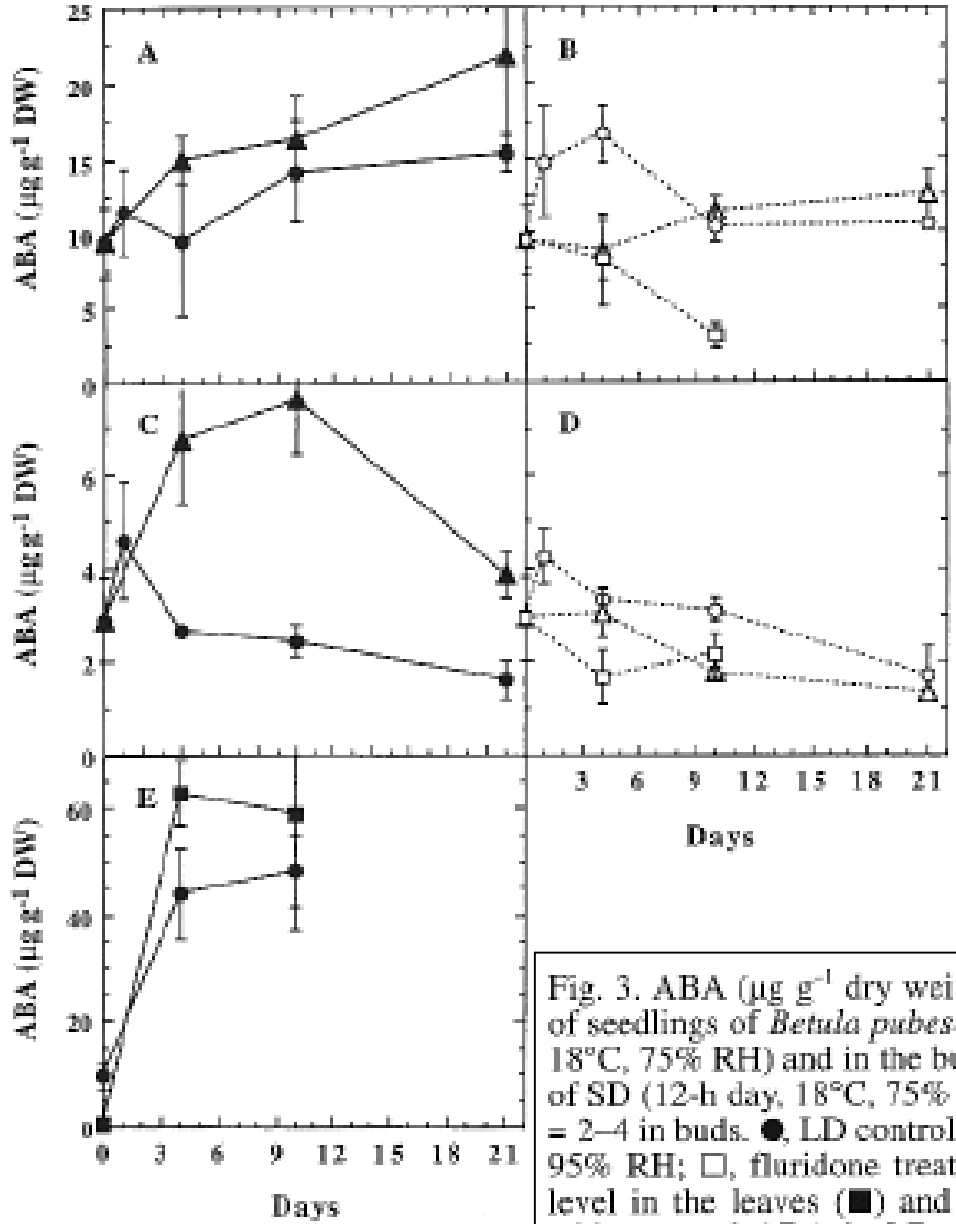


Fig. 3. ABA (μg g^{-1} dry weight) in the buds (A) and leaves (C) of seedlings of *Betula pubescens* in the course of LD (24-h day, 18°C, 75% RH) and in the buds (B) and leaves (D) in the course of SD (12-h day, 18°C, 75% RH). Means ± SE, n = 3 in leaves, n = 2–4 in buds. ●, LD control; ○, SD control; ▲, water stress; △, 95% RH; □, fluridone treatment (2.5 mg $plant^{-1}$ day^{-1}). ABA level in the leaves (■) and buds (●) (E) of seedlings treated with external ABA in LD (25 ml 50 μ*M* ABA day^{-1} sprayed onto the leaves).

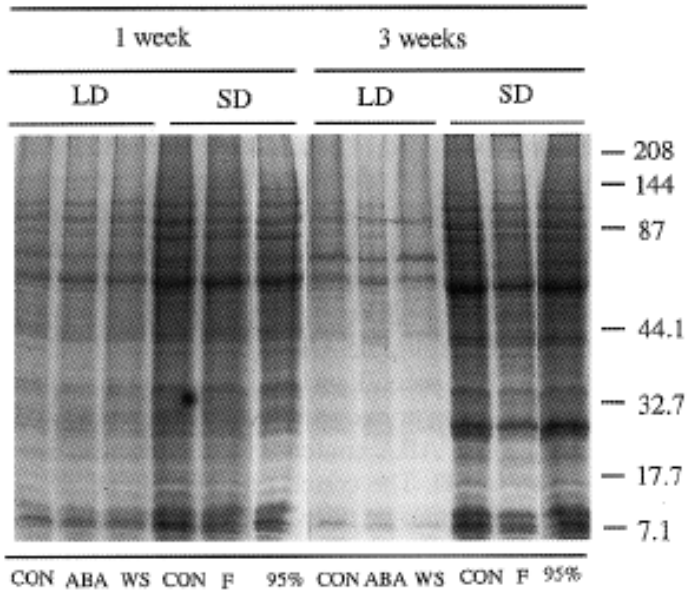


Fig. 4. SDS-PAGE profile of bud proteins extracted from birch grown for 1 or 3 weeks under LD control conditions (CON, 24-h day, 18°C, 75% RH), with external ABA treatment in (ABA, 25 ml 25 μ*M* ABA day^{-1} sprayed onto the leaves) and under water stress (WS), or under SD control conditions (CON, 12-h day, 18°C, 75% RH) or with 95% RH (95%) or fluridone treatment (F, 0.2 mg $plant^{-1}$ day^{-1}). Molecular masses of the protein standards are indicated on the right.

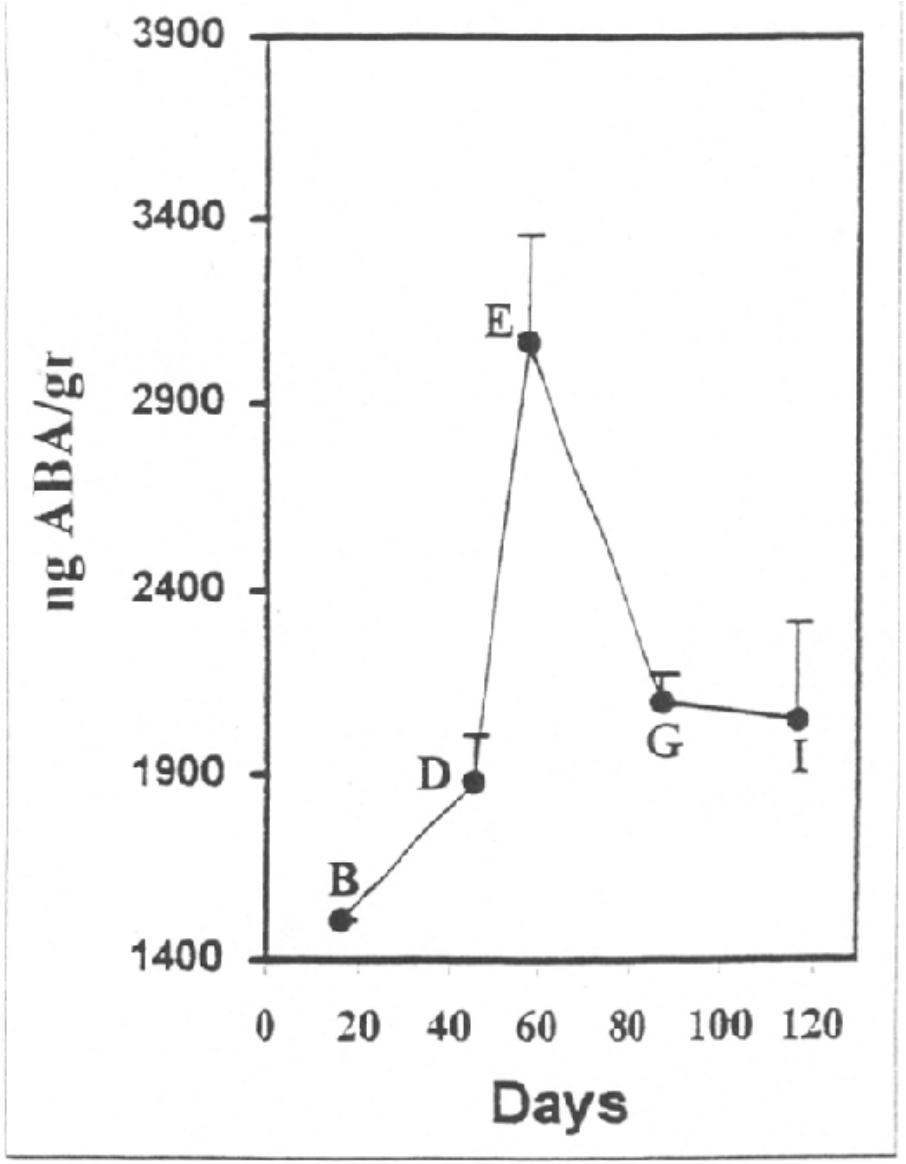


FIG. 2
Changes in total endogenous ABA content in buds during the dormancy cycle. ABA values are the averages of three replications. Bars above the values represent the standard deviation. Letters above the values represent the sampling dates as listed in Table I.

In grapevine buds, ABA levels associated with cold acclimation and dormancy induction but levels decline much before dormancy release

Abscisic acid

Not a universal signal for bud dormancy

In some sps SD conditions enough

In some sps correlation with cold acclimation but not with bud dormancy

Gibberellic Acid

YES, it is used for commercial seed germination
Main ingredient in MegaGro Solution

Table II. Relative concentrations (FW/DW) of GA-like substances in peach flower buds collected from trees grown in Argentina on three different dates (ng GA_3 equivalents)

GA-like substances	Date of sampling		
	June 18	July 18	August 20
Putative GA_{1+3}	161/330	22/48	8/24
Putative GA_{1+3} glucosyls	4/8	0/0	3/9
Putative GA_8	0/0	5/11	0.3/1

GA can substitute for chilling in peach but not fully

Cytokinins

Probably play a role in bud growth after the dormancy is broken

Indole acetic acid (Auxin)

Decrease in IAA levels reported as birch buds enter dormancy

Contradictory reports exist for all such observations

Several factors need to be considered

- **Hormone compartmentation: Apoplast, cytoplasm, vacuole, organelles**
- **Presence or absence of hormone specific receptor. Active/inactive state**
- **Signal transduction: All events between formation of Hormone – Receptor complex and response of interest**

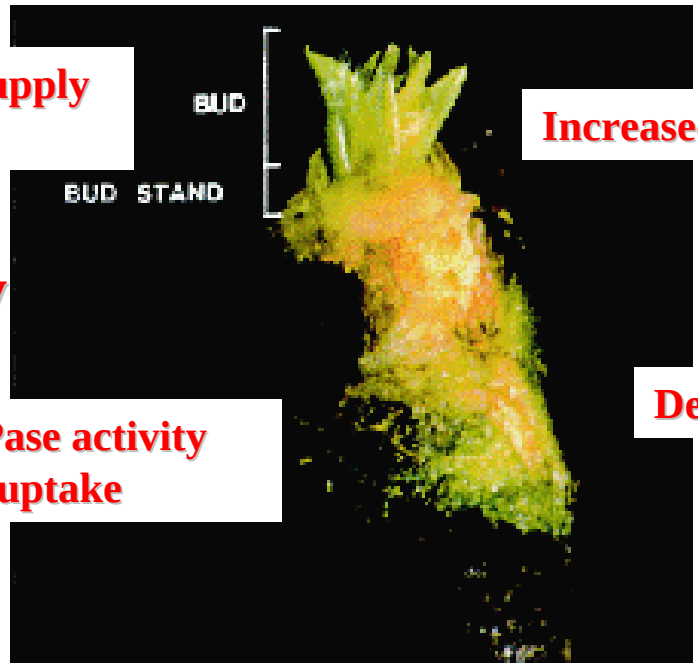
Nutritional

Nutrient Diversion Hypothesis (Proposed by Sachs 1977)

Peach bud dormancy. Aue et al 1999

Decreased metabolic supply
Growth inhibition

Increased ATPase activity



Onset of dormancy

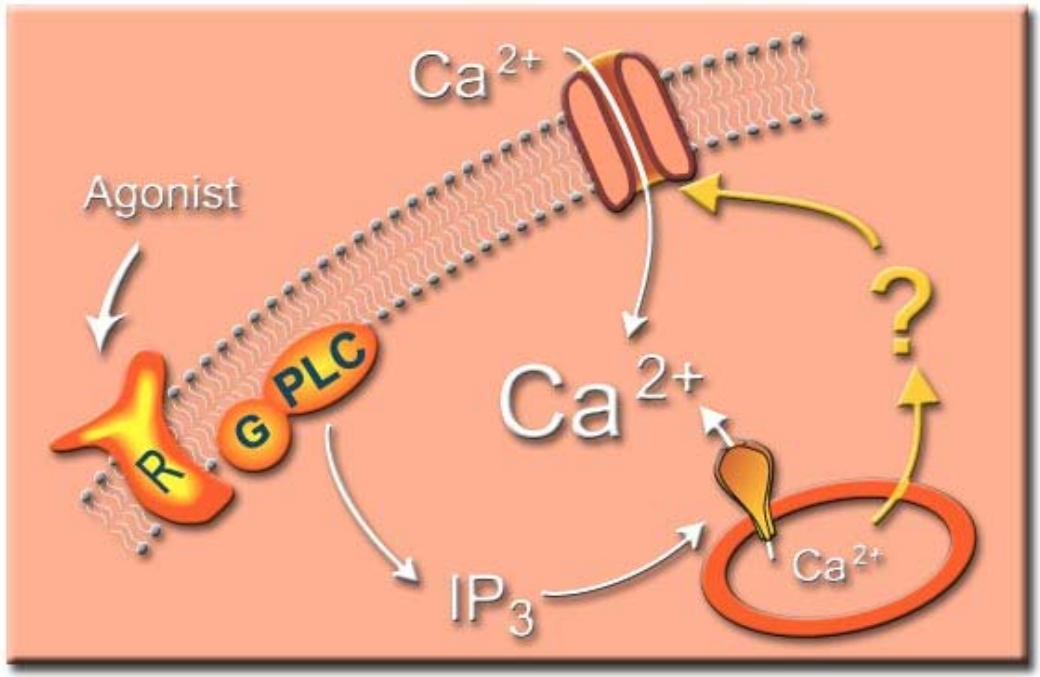
Increased H+ ATPase activity
Increased sucrose uptake

Decreased ATPase activity

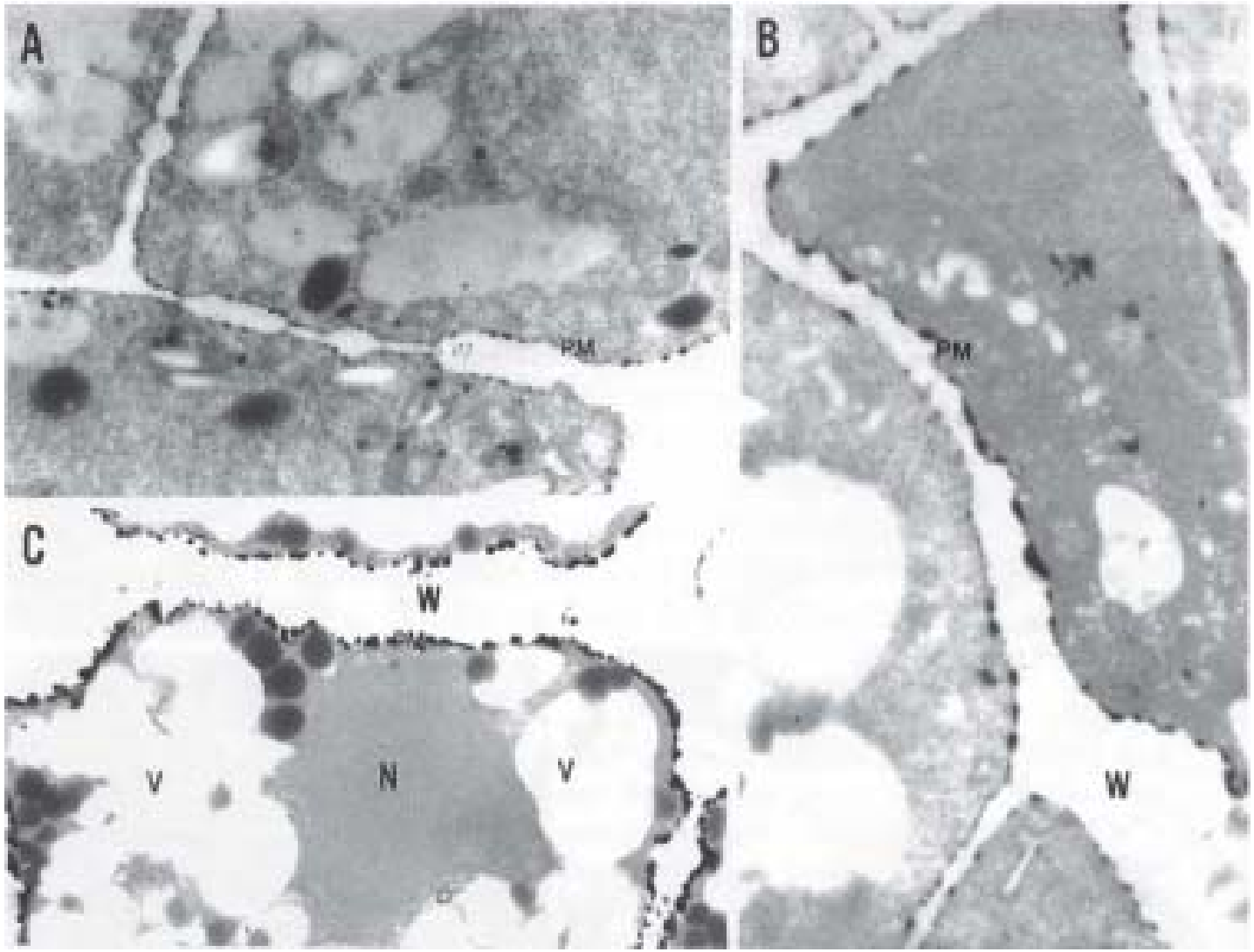
Release of dormancy

Calcium

Ion transport
Gene expression



- **During active growth Ca2+ present in vacuoles, cell wall and intercellular spaces**
- **As PP and T decrease, Ca2+ increases in cytosol, nucleus**
- **Ultrastructural changes observed. Thickened cell wall, decrease in plasmodesmata connections**
- **Symport transport stops**
- **limited cell to cell communication**
- **may lead to dormancy**



EM-cytochemical localization of Ca2+-ATPase activity in the apical bud cells of poplar plants grown under SD conditions for 28 d. No reaction products of the enzymatic activity were observed on the interior face of the PM. In contrast, many cerium phosphate precipitated grains were seen on the exterior face of the PM. V: Vacuole. A, 12000 ; B, 19000 ; C, 12000 .

Questions????

1. **Name four factors responsible for onset and release of dormancy.**
2. **Is ABA absolutely essential for bud dormancy?**
3. **What other dormancy related phenomenon is ABA associated with?**
4. **List the factors that need to be considered in studying the role of hormones in bud dormancy.**
5. **What intercellular channels are blocked in case of bud dormancy?**
6. **Do you think there is a global factor for bud dormancy?**