

Control of bolting and flowering in sugar beet

Pierdomenico Perata

Antonietta Santaniello



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Sant'Anna
di Studi Universitari e di Perfezionamento

Early flowering in sugar beet



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Early flowering in sugar beet

Troubles:

Lower yield

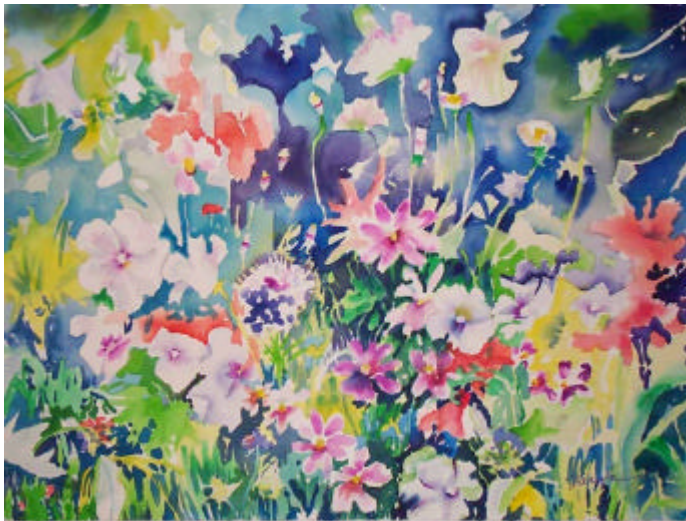
Difficult harvest

Increases seed dispersal ("wild beet")



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The physiology of flowering



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Photoperiodic control of flowering



Vernalisation

cauliflower plant
grown 5 years in a
heated greenhouse



Vernalised
cauliflower plant
=
flowering

Vernalisation in sugar beet

Sugar beet plants require vernalisation

Temperature: 8°C

Length: ~ 70 gg

Early flowering

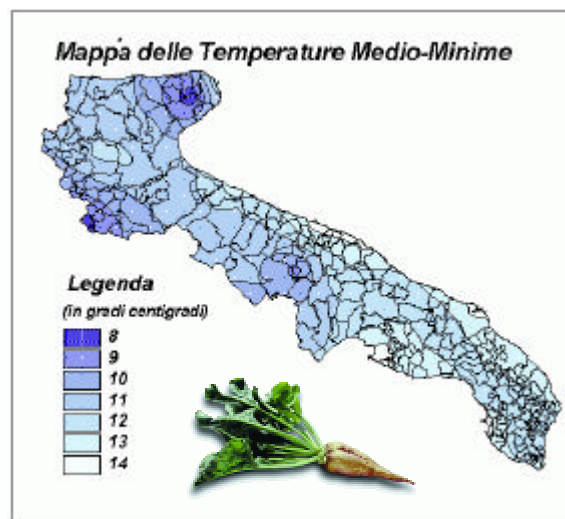
Spring sowing (4-6 leaves stage)

Fall sowing

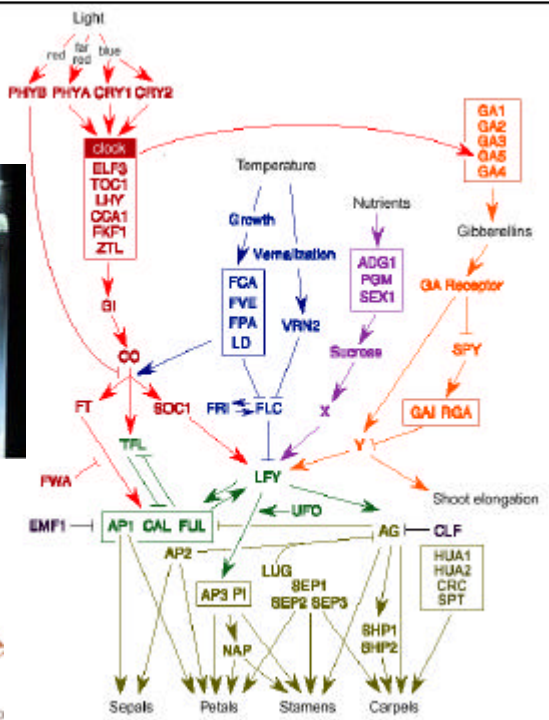
Temperature: 3-5°C

Length: few days

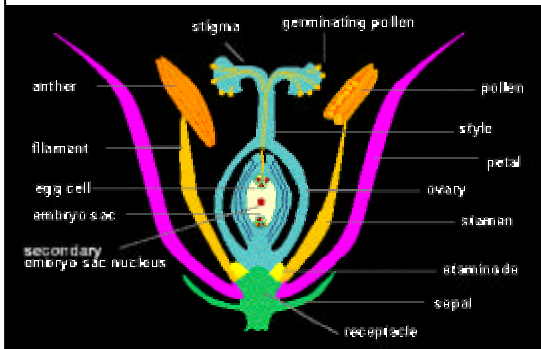
Low temperatures in southern Italy



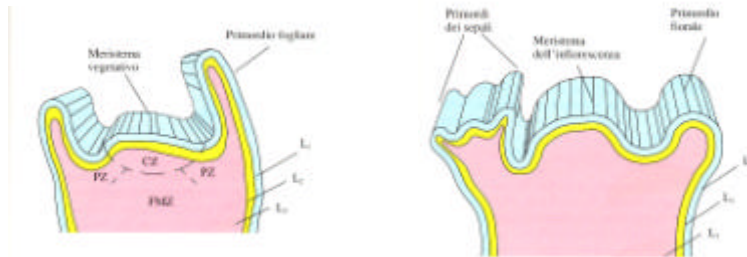
Molecular biology of flowering



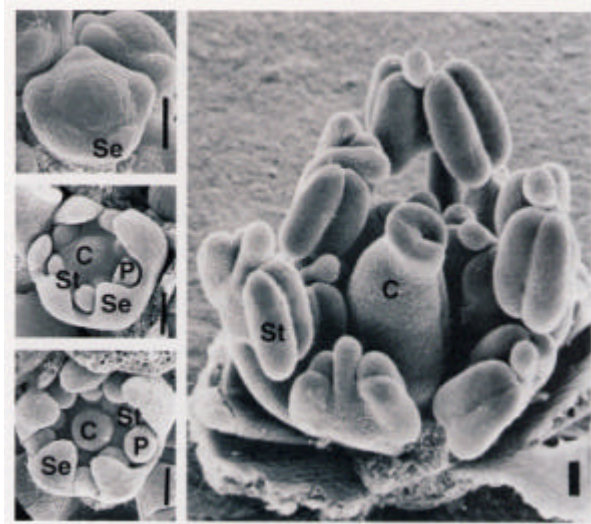
Molecular biology of flowering



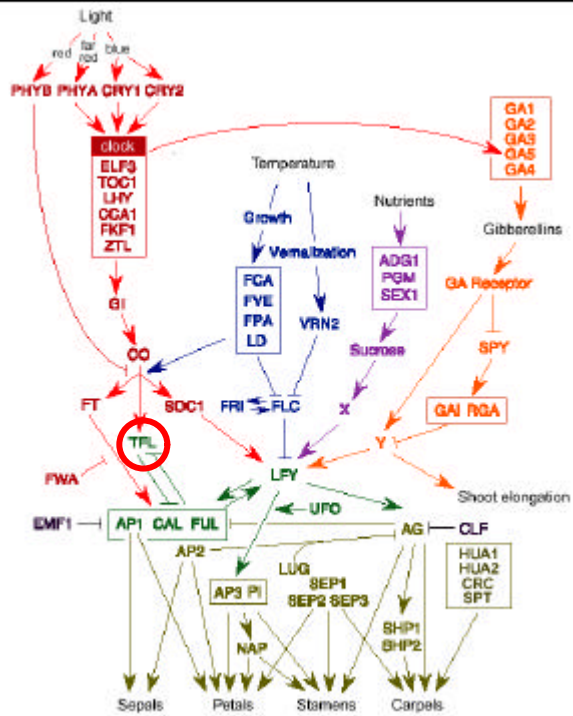
Transition from vegetative to flowering meristem



Transition from vegetative to flowering meristem

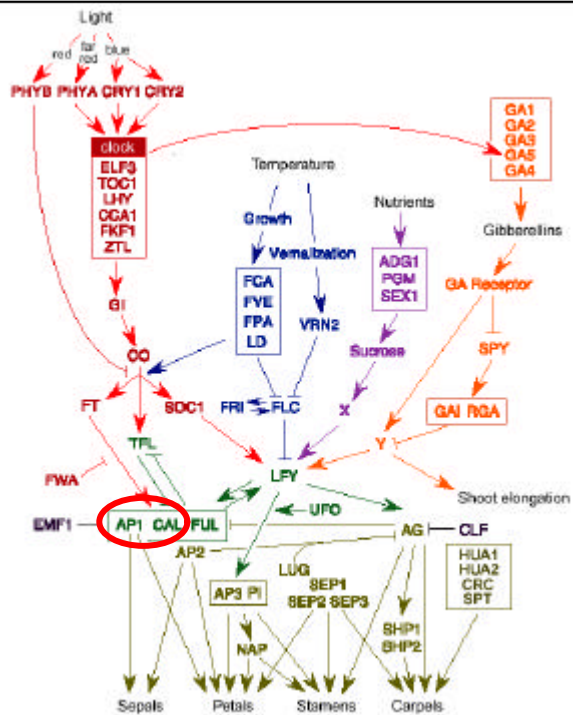


Flower and inflorescence identity: “terminal flower” gene



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Mutations in CAL and AP1 results in a strong inflorescence phenotype



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The ABC model

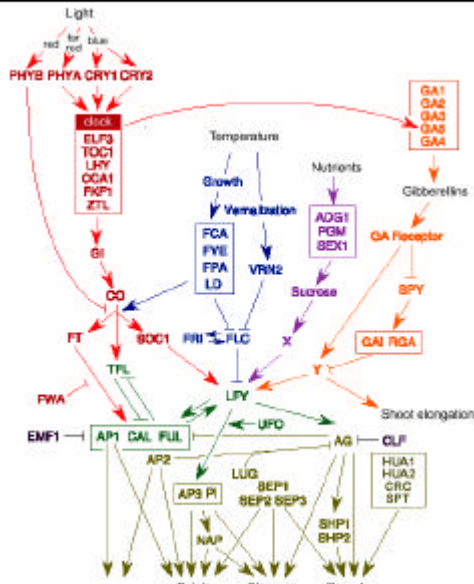
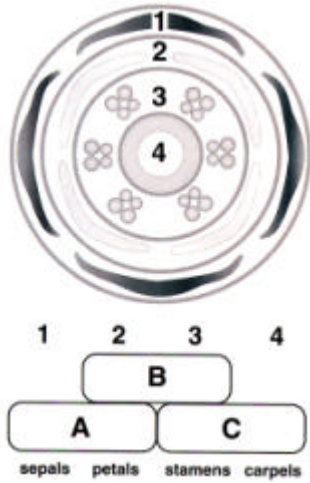


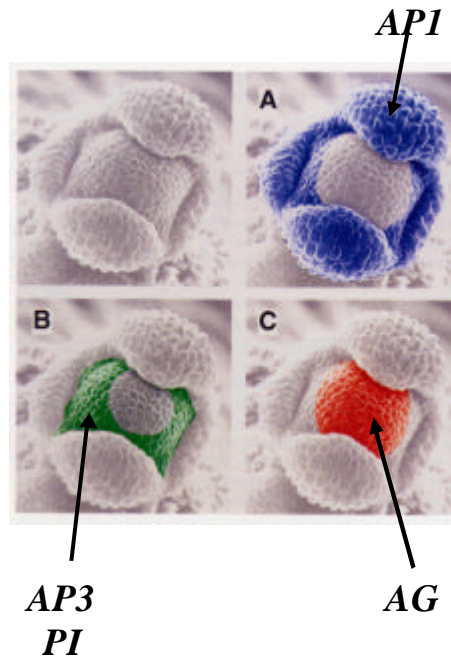
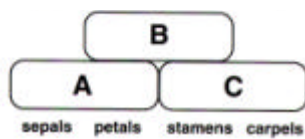
Table 8.1 Floral Homeotic Genes in Arabidopsis and Antirrhinum

Class	Arabidopsis	Antirrhinum
Class A	APETALA 1 (AP1), APETALA 2 (AP2)	SQUAMOSA (SQA)
Class B	APETALA 3 (AP3), PISTILLATA (PI)	DEFICIENS (DEF), GLOBOSA (GLO)
Class C	AGAMOUS (AG)	PLENA (PLE)

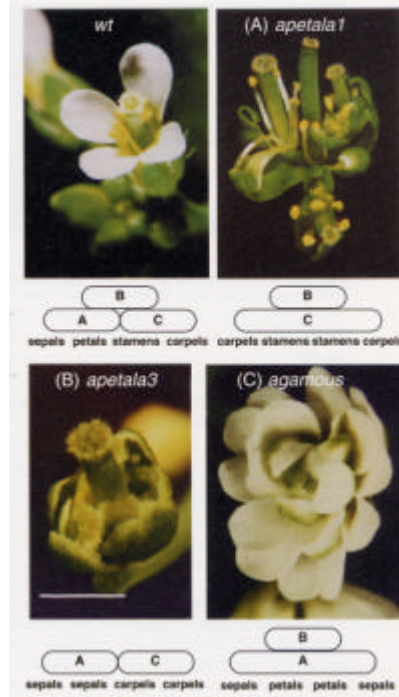
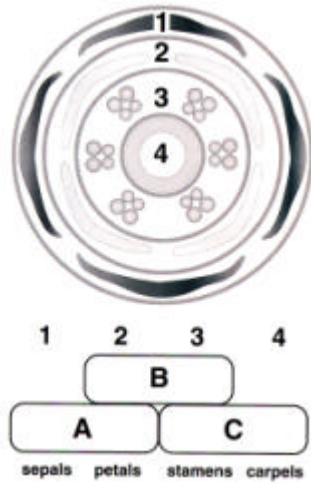
The ABC model

Positive interaction between genes coding for the same function.

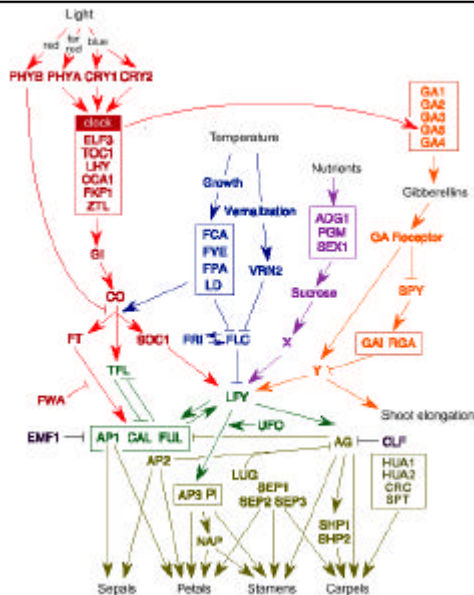
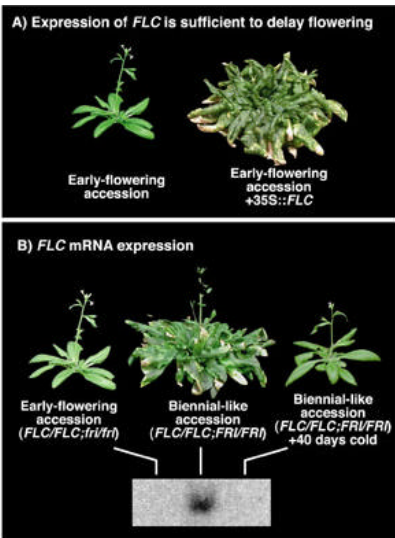
A genes and C genes compete and the expression of one class excludes the expression of the other class



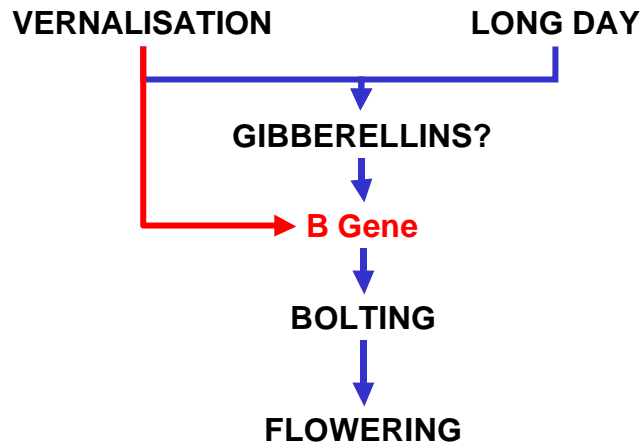
The ABC model



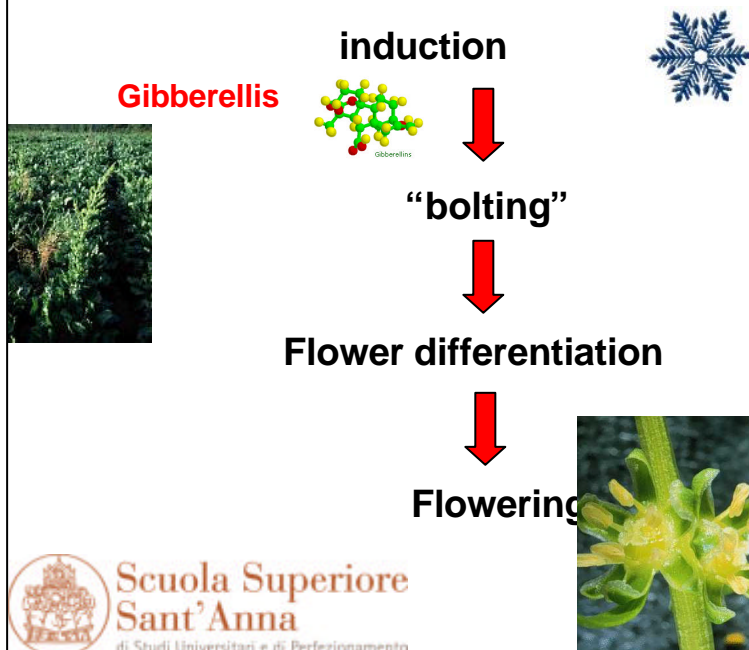
Vernalisation



Physiology and genetics of flowering in sugar beet

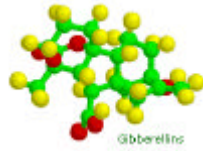


Early flowering in sugar beet



Hormonal modulation of flowering

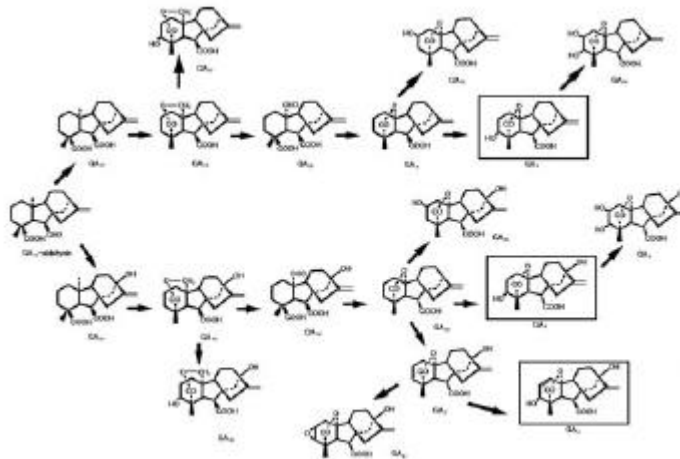
Gibberellins



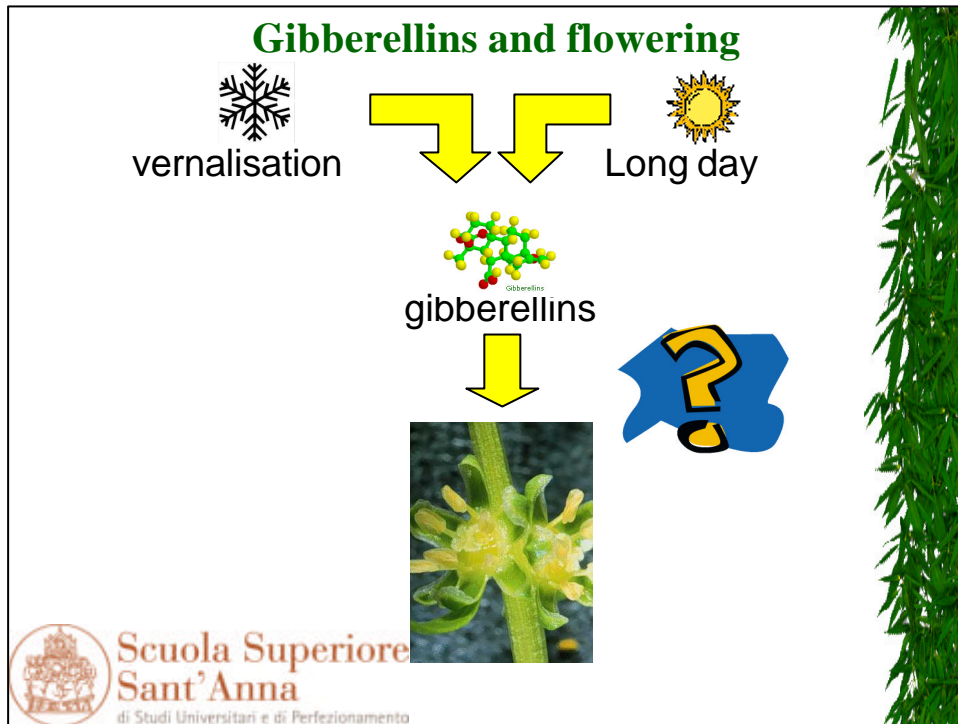
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Hormonal modulation of flowering




Gibberellins

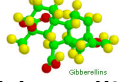



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Gibberellins and flowering

 vernalisation
 
 Long day

 gibberellins
 

bolting and flowering are distinct processes
 (bolting without flowering is possible)
GA₃ induces bolting
 (without vernalisation and long day conditions)
GA₃ cannot induce flowering
 (unless vernalisation and long day conditions occur)


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(Margara, 1960)

Gibberellins and flowering

in some carrot CV GA₃ induce flowering (replacing vernalisation)



in *Lolium temulentum*:
GA₅® flowering induction
GA₁+GA₄® differentiation
(King et al., 2001)

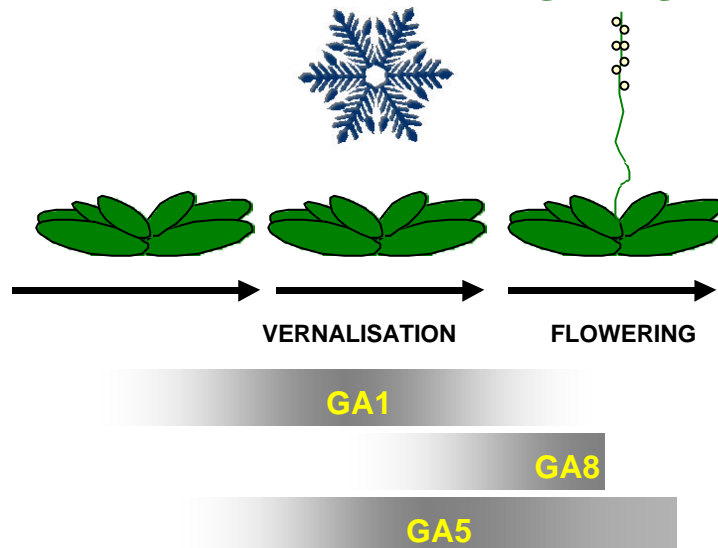


In *Vitis vinifera*
gibberellins inhibit flowering



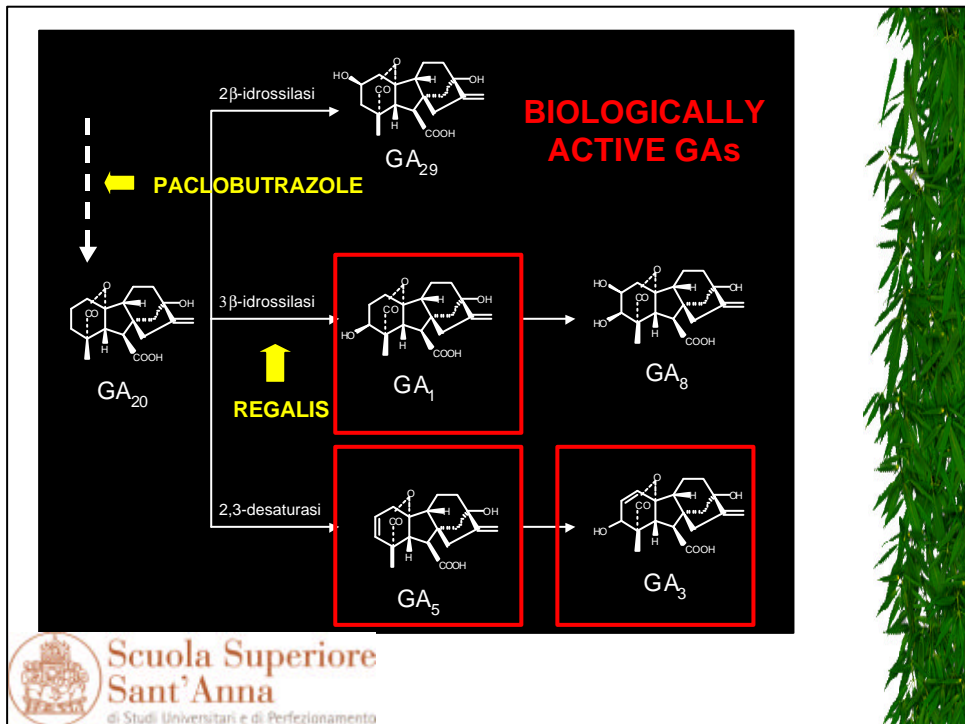
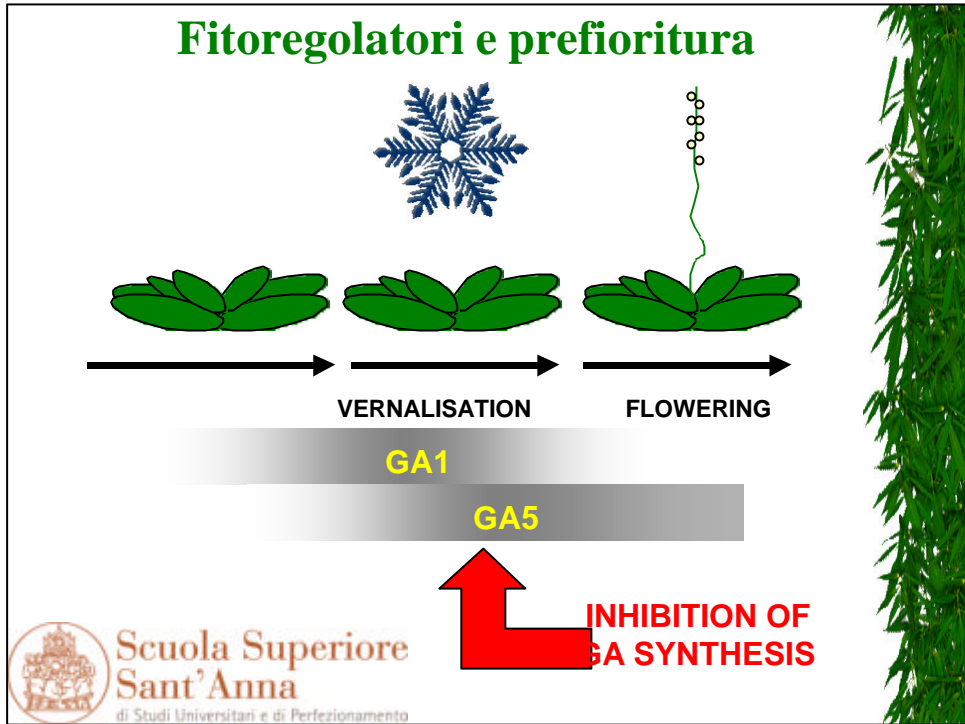
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Gibberellins and flowering in sugar beet



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Data: SORCE & LORENZI, UniPISA



CONCLUSION:

Selection of CV with lower tendency to
early flowering

Identification of genes responsible for
the vernalisation response

