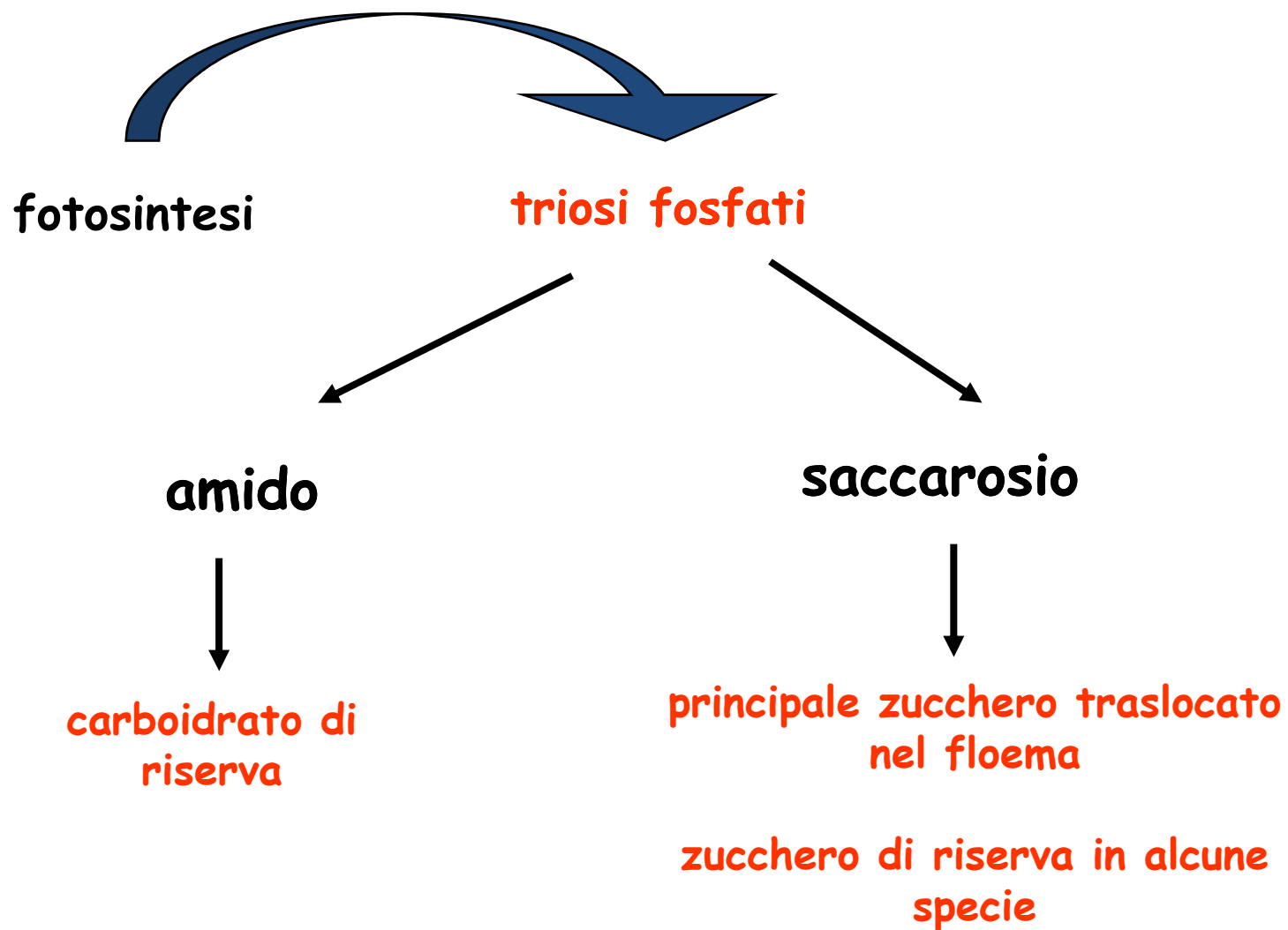
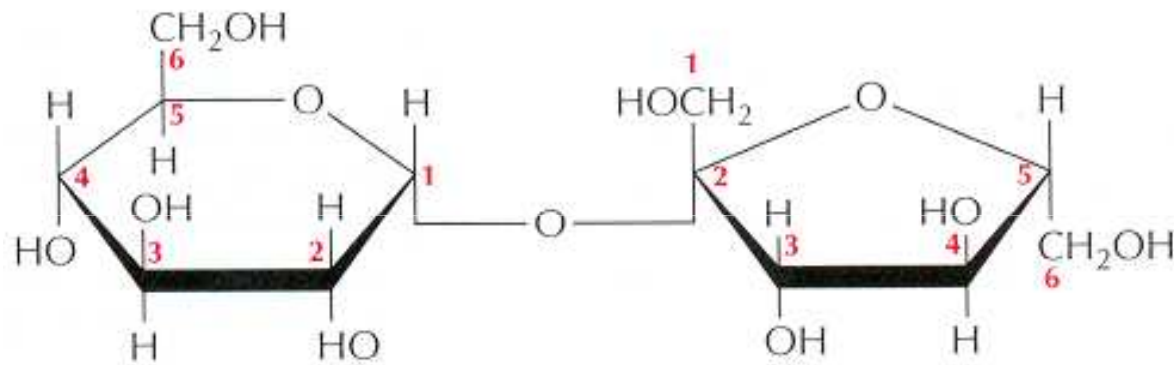


AMIDO E SACCAROSIO

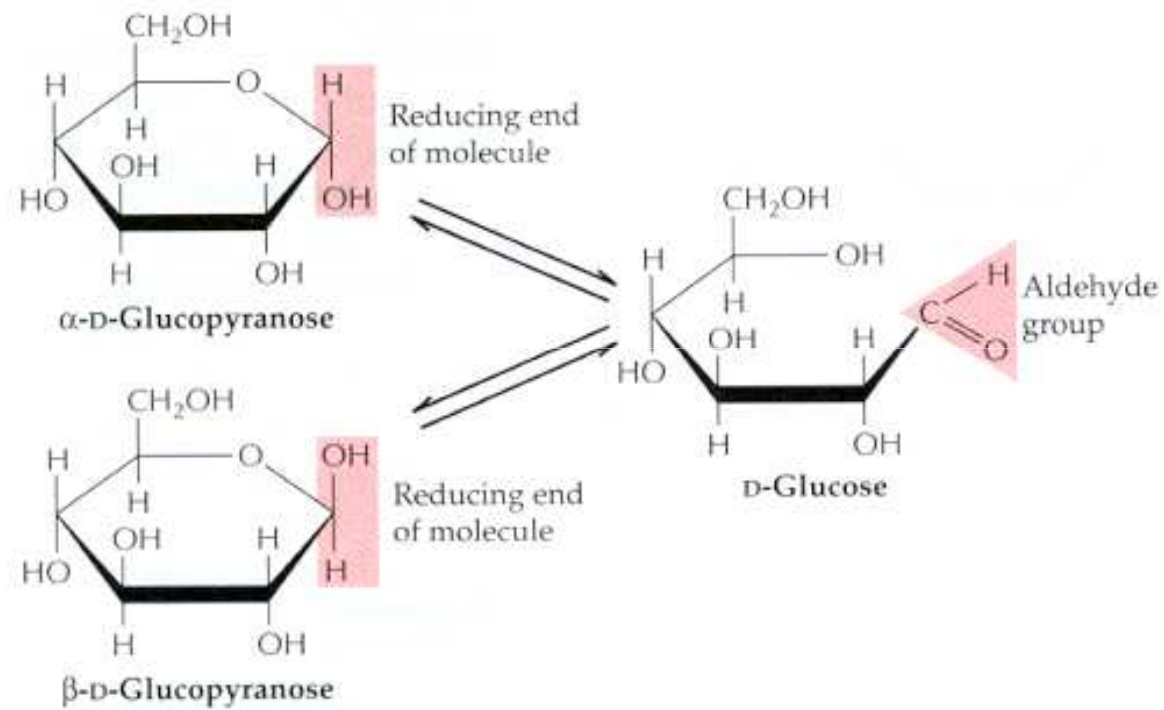


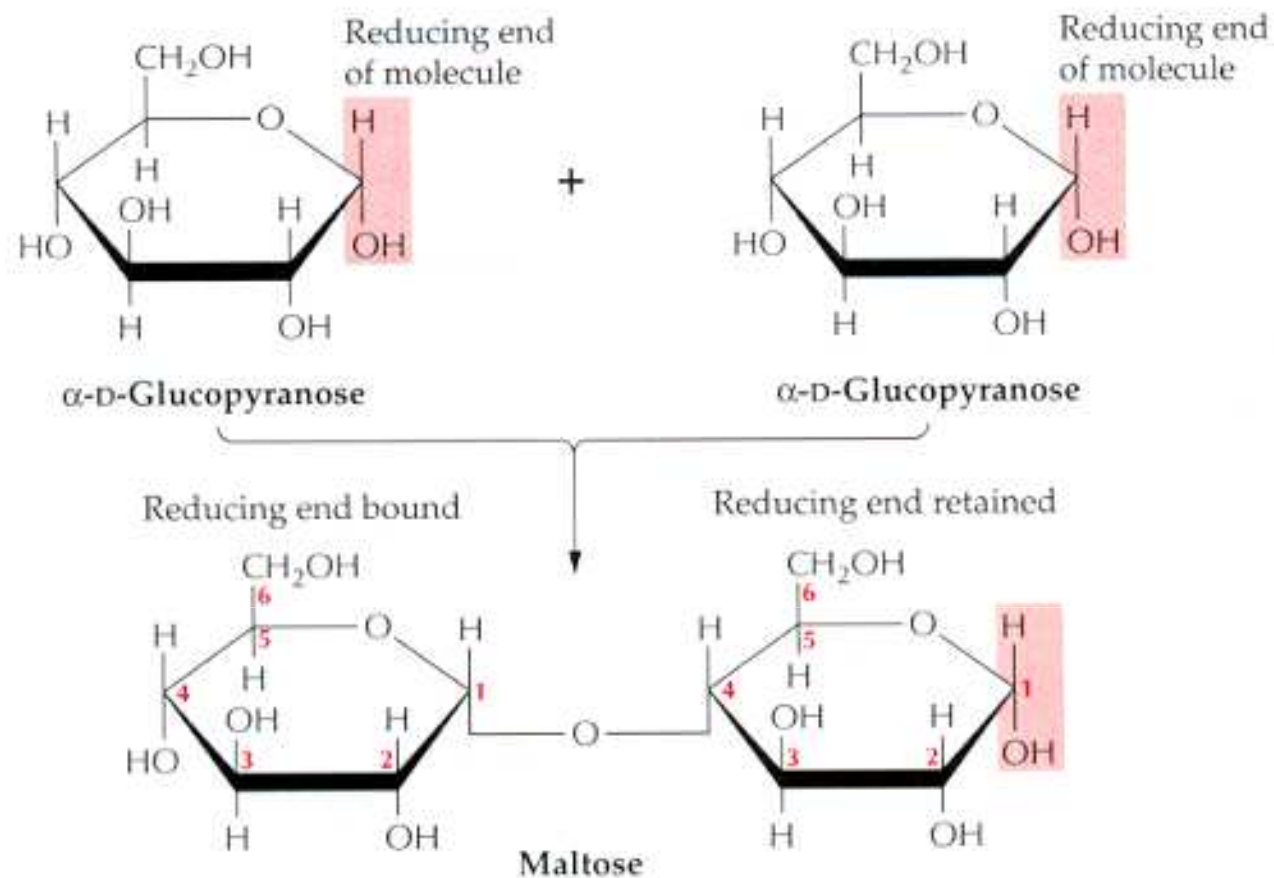
SACCAROSIO



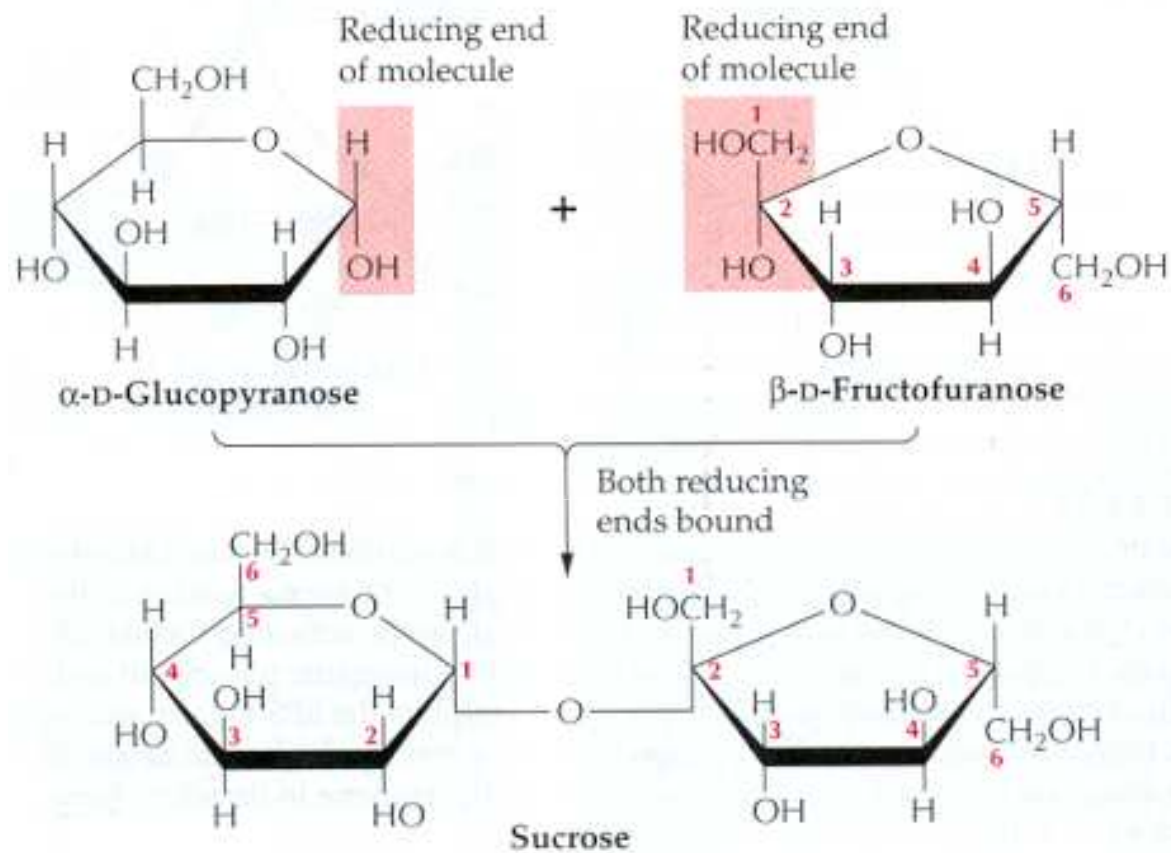
disaccaride composto da glucosio e fruttosio
legame α (1 $\rightarrow$ 2)

**isomeri
emiacetali**





il maltosio è uno zucchero riducente



il saccarosio è uno zucchero non riducente

AMIDO

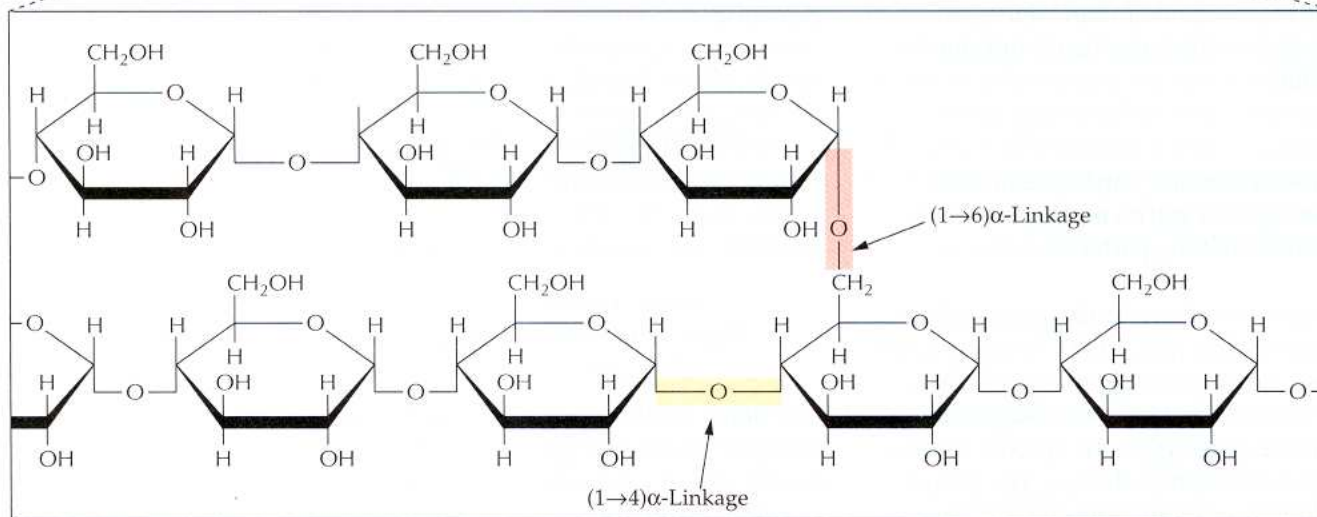
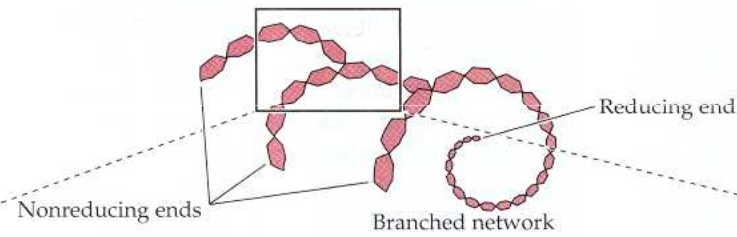
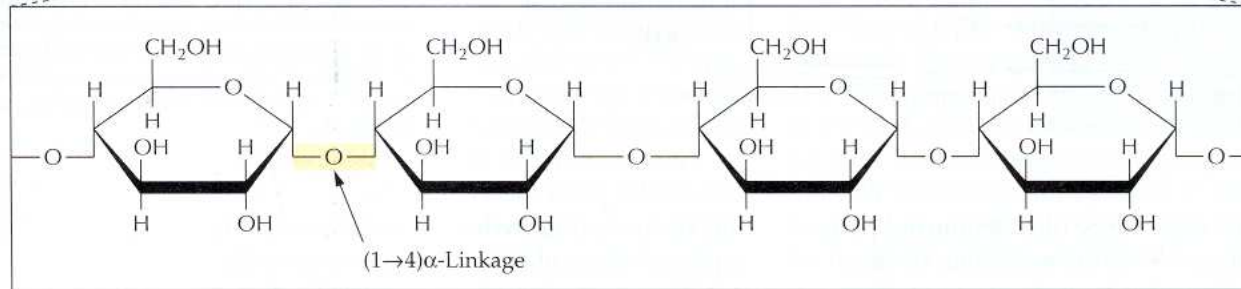
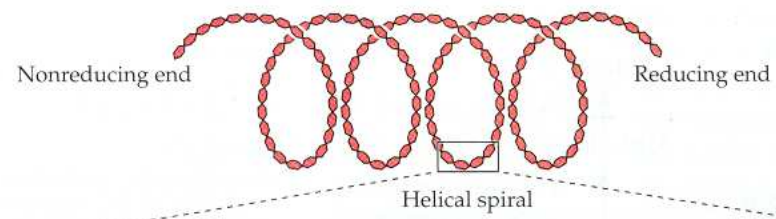
α -amilosio

catene lunghe e non ramificate
di unità di glucosio legate da
legami α 1 $\rightarrow$ 4

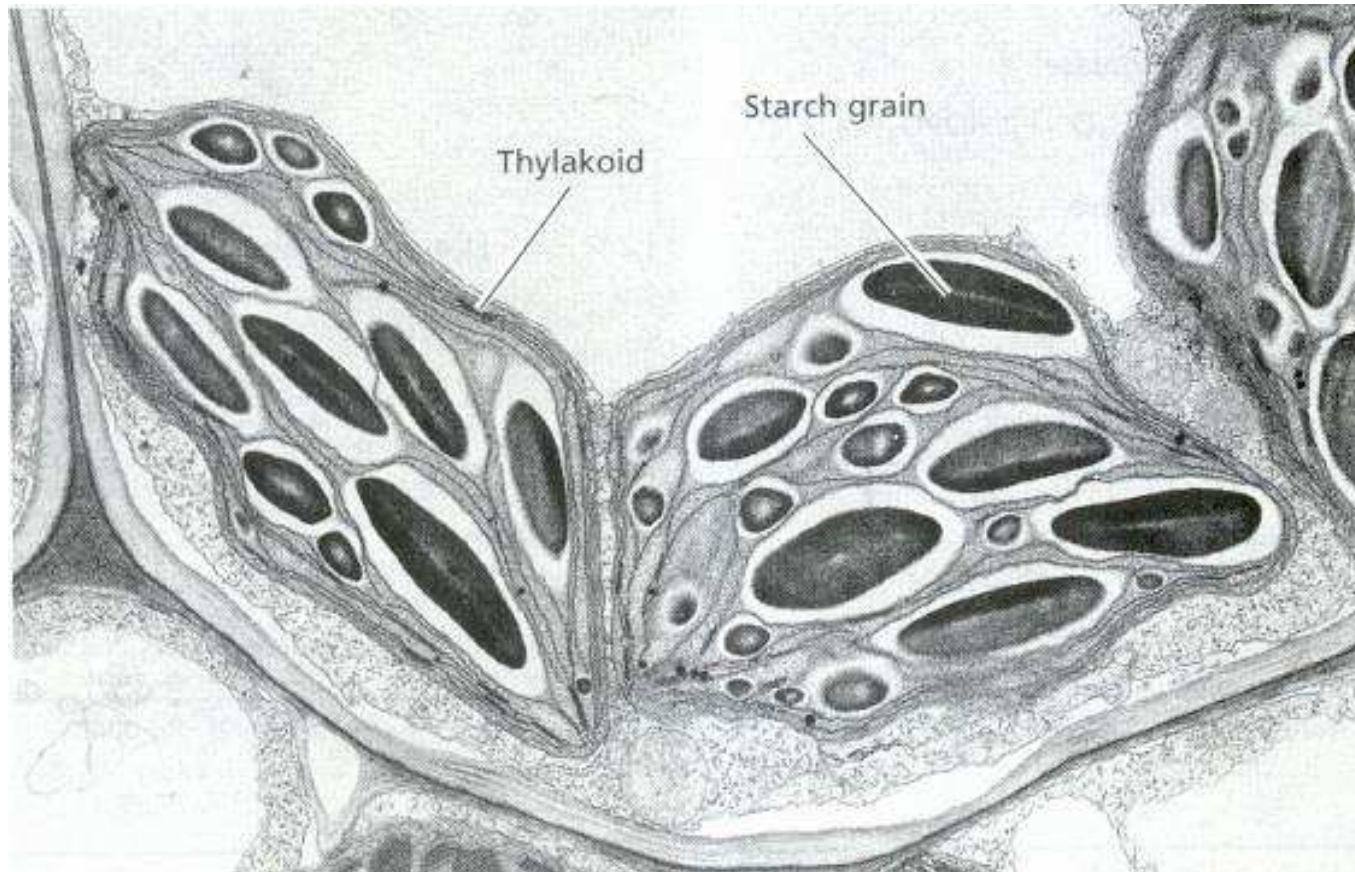
amilopectina

catene di glucosio legate da
legami α 1 $\rightarrow$ 4 con ramificazioni
ogni 20-30 residui
(legami α 1 $\rightarrow$ 6)

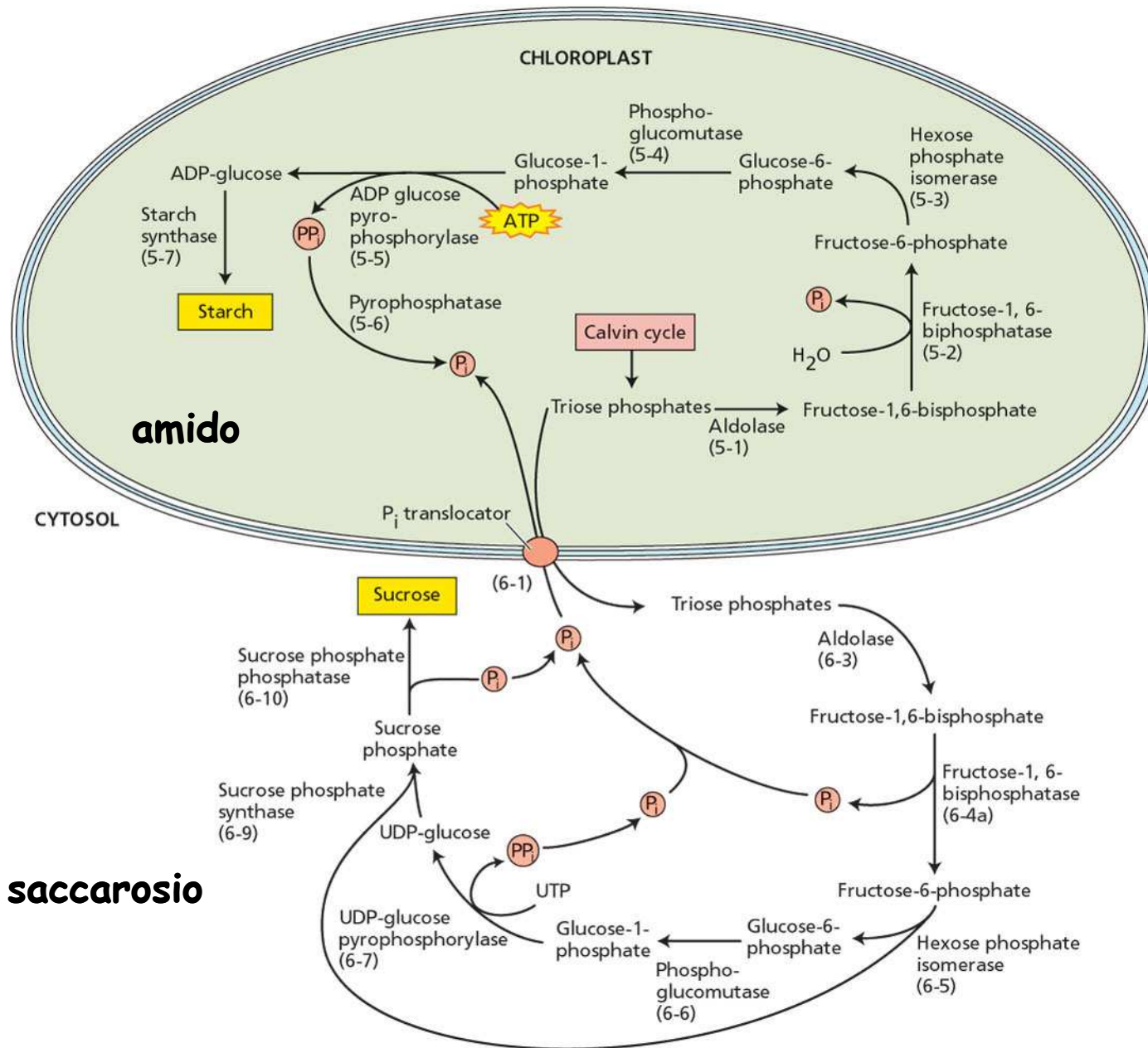
Organizzato in granuli delle dimensioni di 1-100 μ m



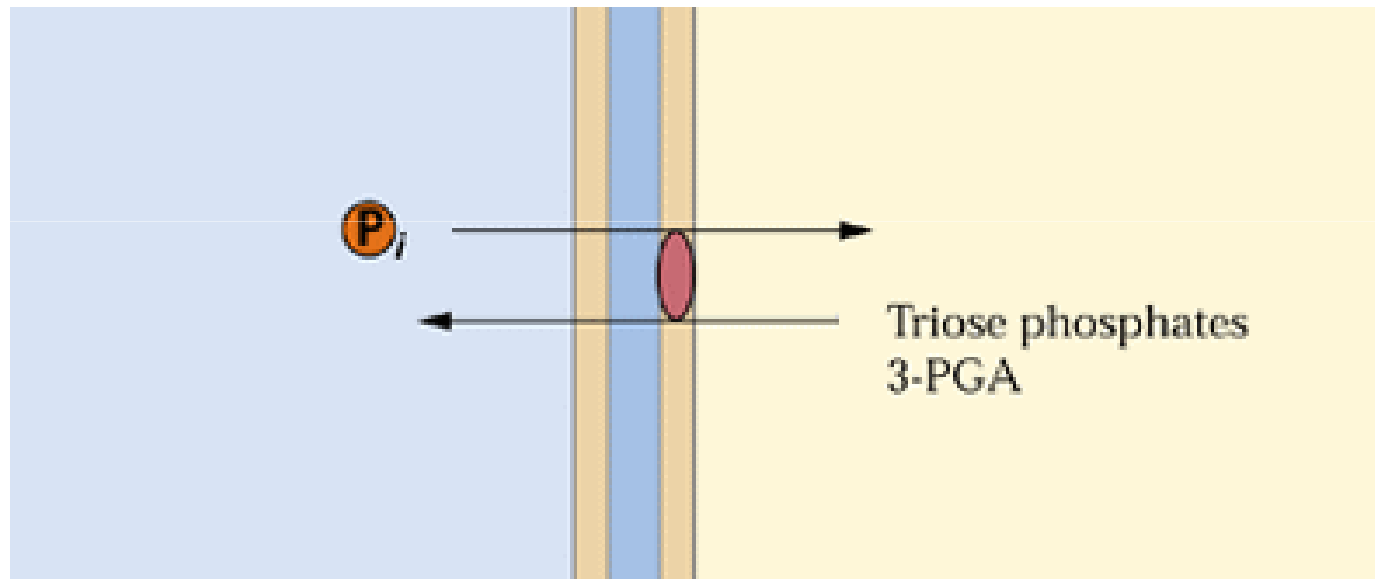
La sintesi dell'amido avviene nei cloroplasti

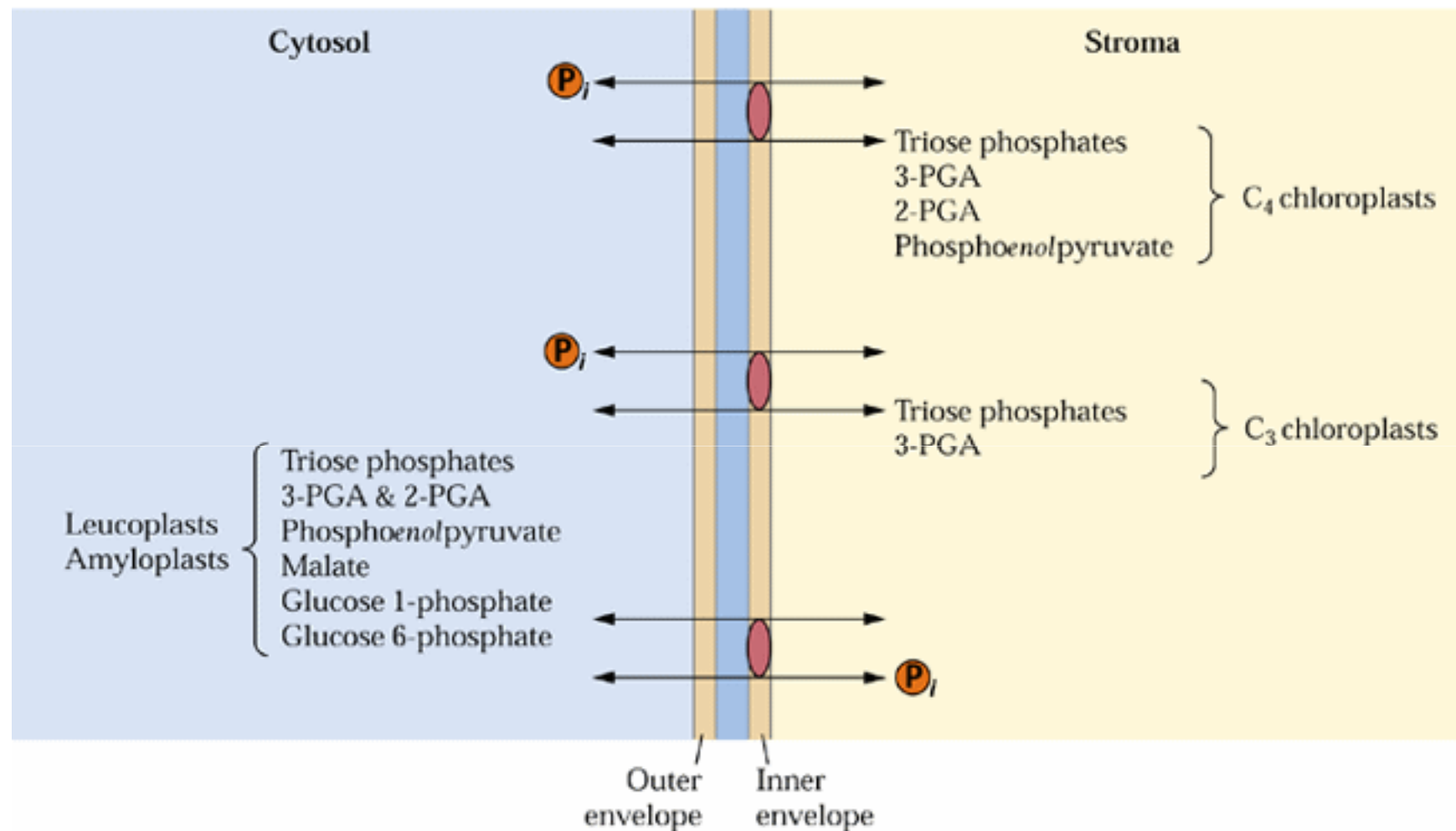


La sintesi del saccarosio avviene nel citoplasma

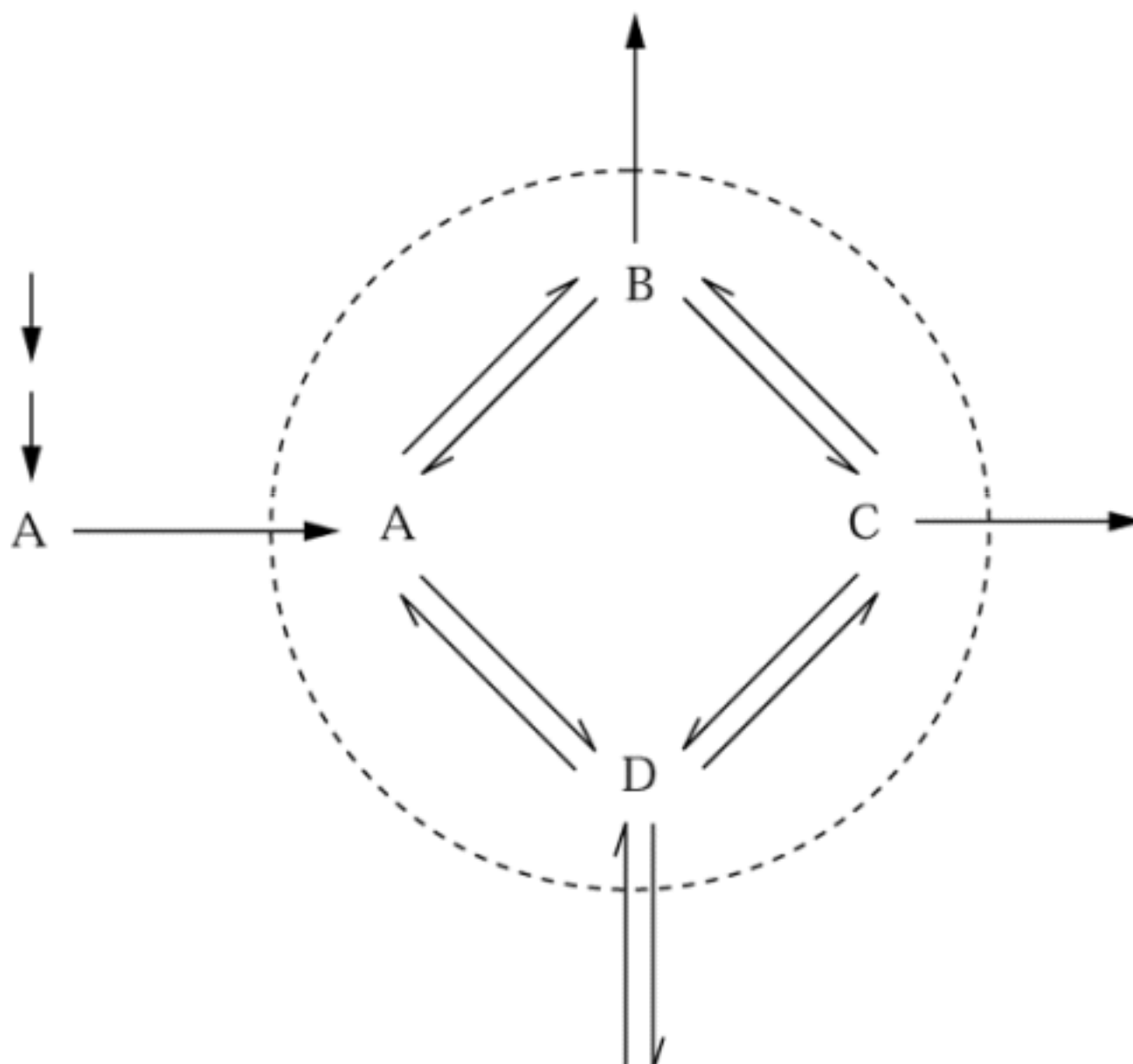


il **TRASLOCATORE DEI FOSFATI** regola il flusso di trioso fosfati tra cloroplasto e citoplasma

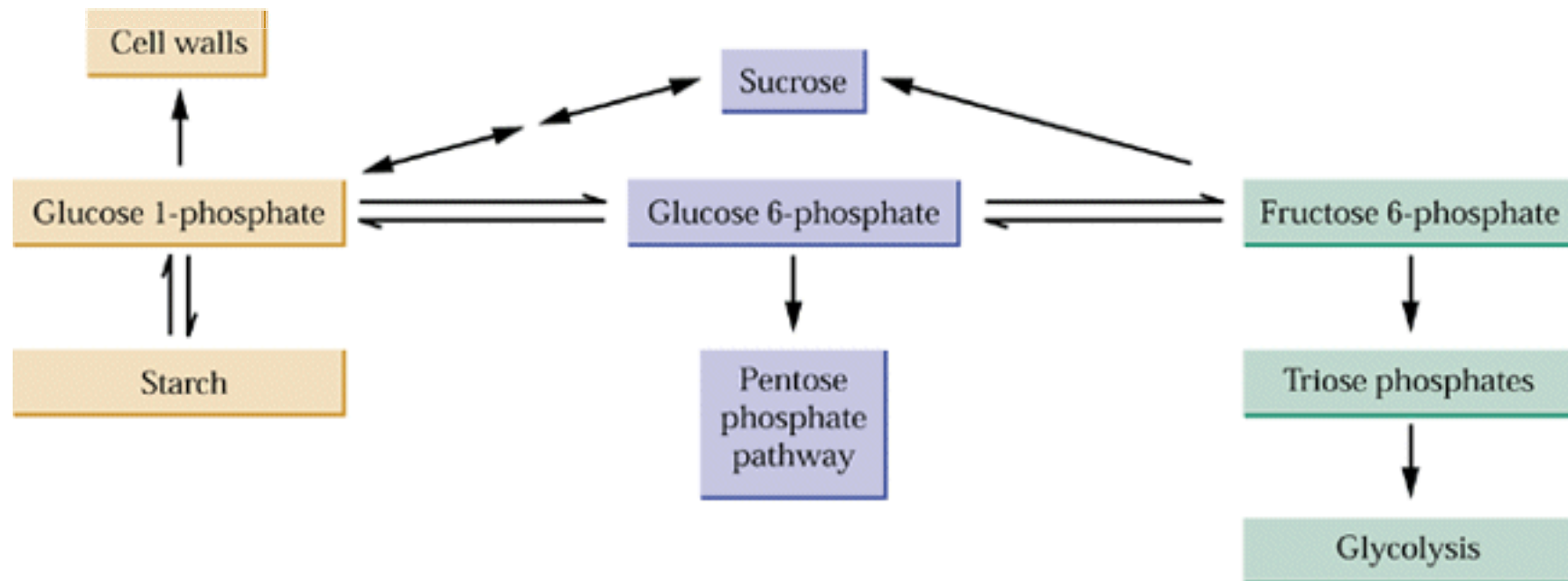
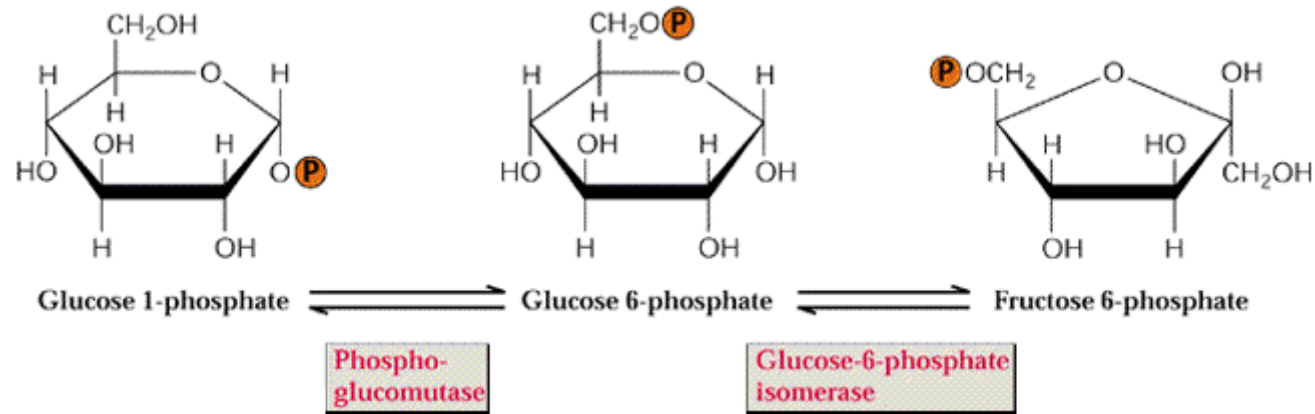




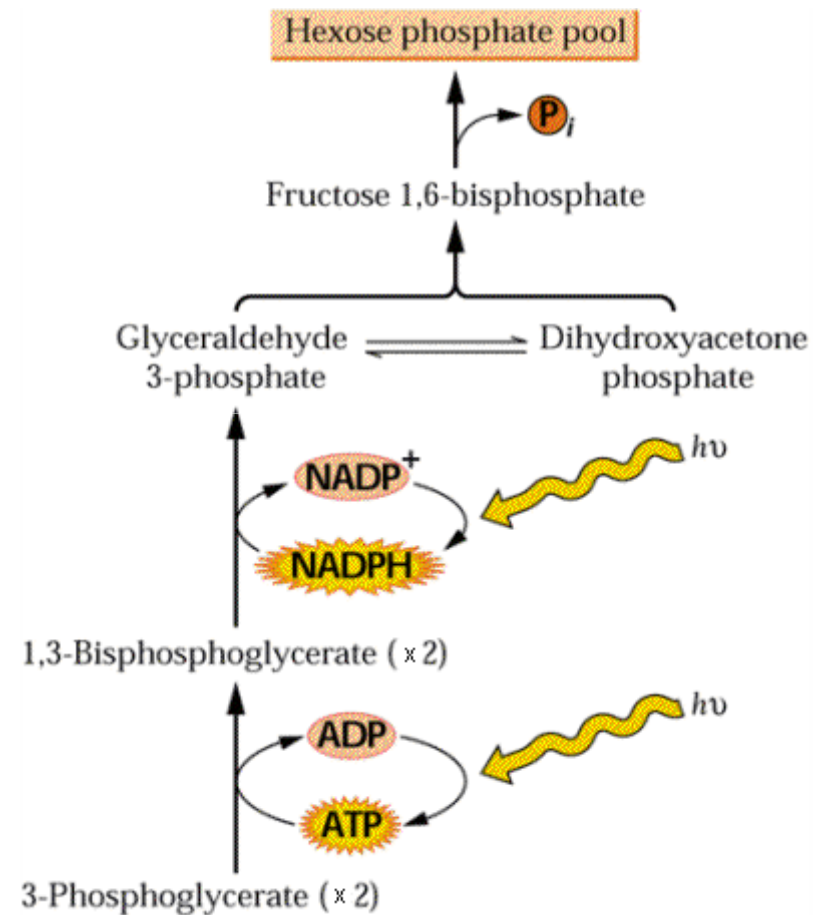
POOL METABOLICI

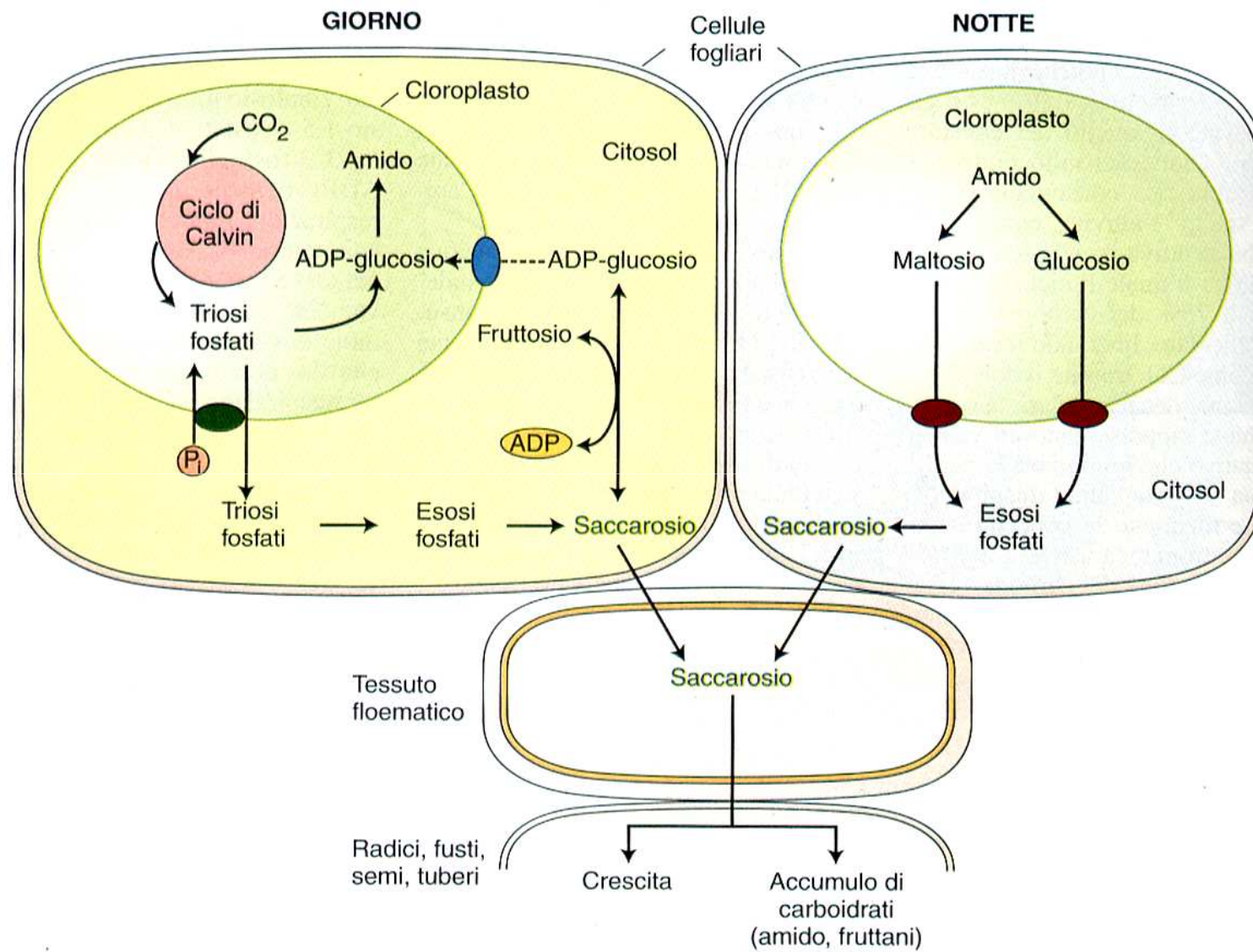


POOL DEGLI ESOSI FOSFATI



Nei cloroplasti il **pool degli esosi fosfati** dipende fortemente dall'attività fotosintetica





sintesi del saccarosio

trasporto del trioso fosfato

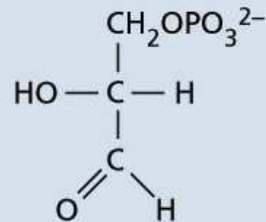
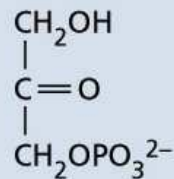
1. *Phosphate/triose phosphate translocator*

Triose phosphate (chloroplast) + P_i (cytosol) $\rightarrow$ triose phosphate (cytosol) + P_i (chloroplast)

isomerizzazione

2. *Triose phosphate isomerase*

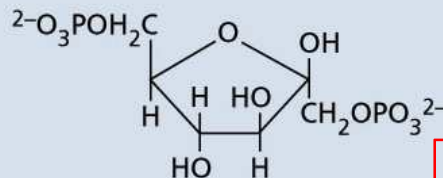
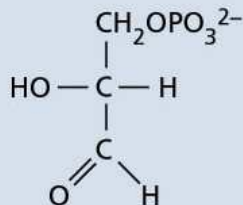
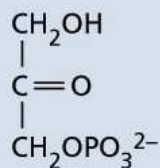
Dihydroxyacetone-3-phosphate $\rightarrow$ glyceraldehyde-3-phosphate



formazione del fruttosio 1,6-bisfosfato

3. Fructose-1,6-bisphosphate aldolase

Dihydroxyacetone-3-phosphate + glyceraldehyde-3-phosphate → fructose-1,6-bisphosphate

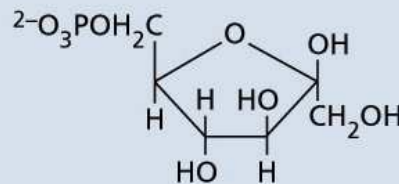
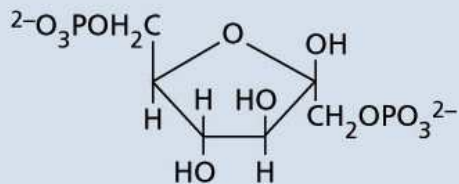


$$\Delta G^\circ = -24 \text{ kJ/mol}$$

formazione del fruttosio 6-fosfato

4a. Fructose-1,6-phosphatase

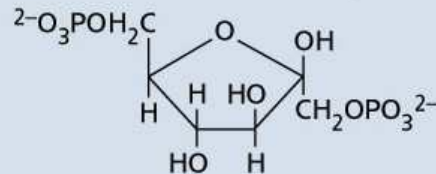
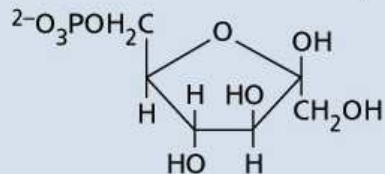
Fructose-1,6-bisphosphate + H₂O → fructose-6-phosphate + P_i



$$\Delta G^\circ = -16,7 \text{ kJ/mol}$$

4b. PP_i-linked phosphofructokinase

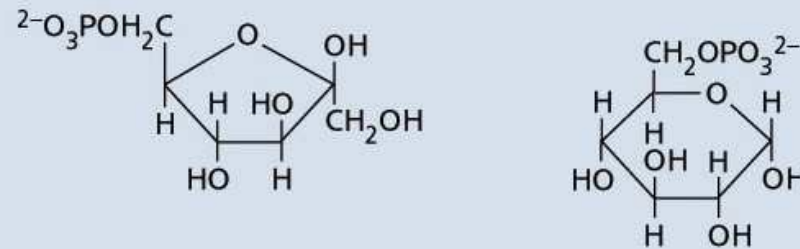
Fructose-6-phosphate + PP_i → fructose-1,6-bisphosphate + P_i



isomerizzazione

5. *Hexose phosphate isomerase*

Fructose-6-phosphate → glucose-6-phosphate

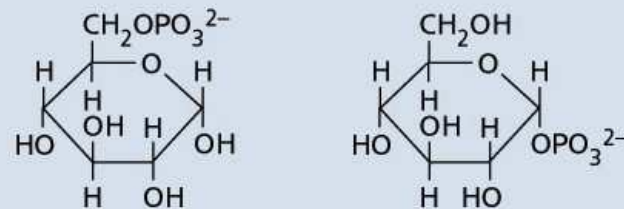


$$\Delta G^\circ = 8,7 \text{ kJ/mol}$$

formazione del glucosio 1-fosfato

6. *Phosphoglucomutase*

Glucose-6-phosphate → glucose-1-phosphate



$$\Delta G^\circ = 7,3 \text{ kJ/mol}$$

formazione dell'UDP-glucosio

7. *UDP-glucose pyrophosphorylase*

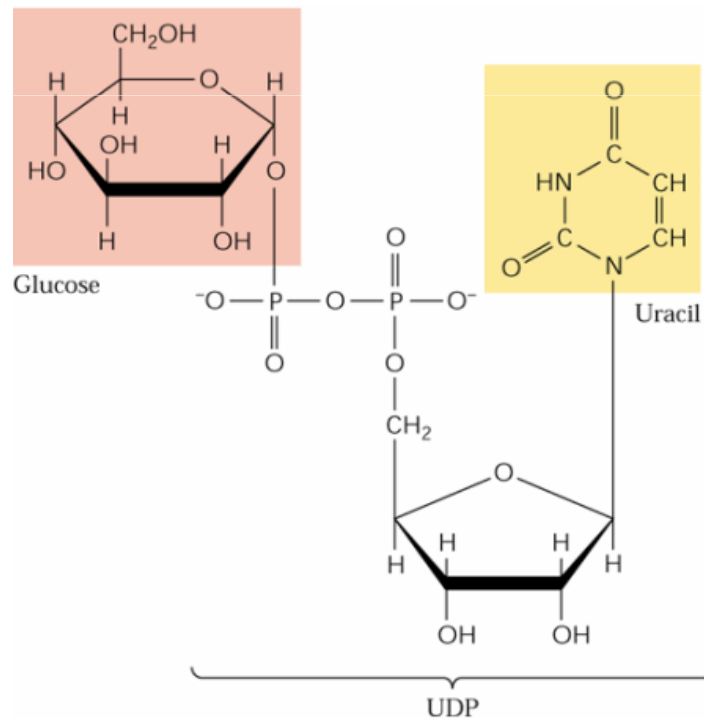
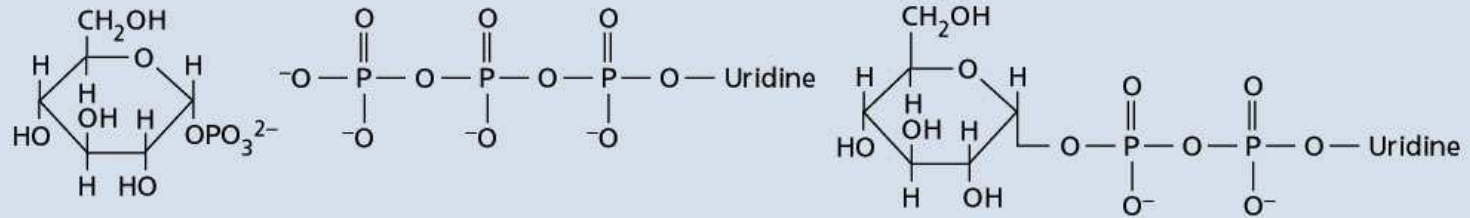
Glucose-1-phosphate

+

UTP

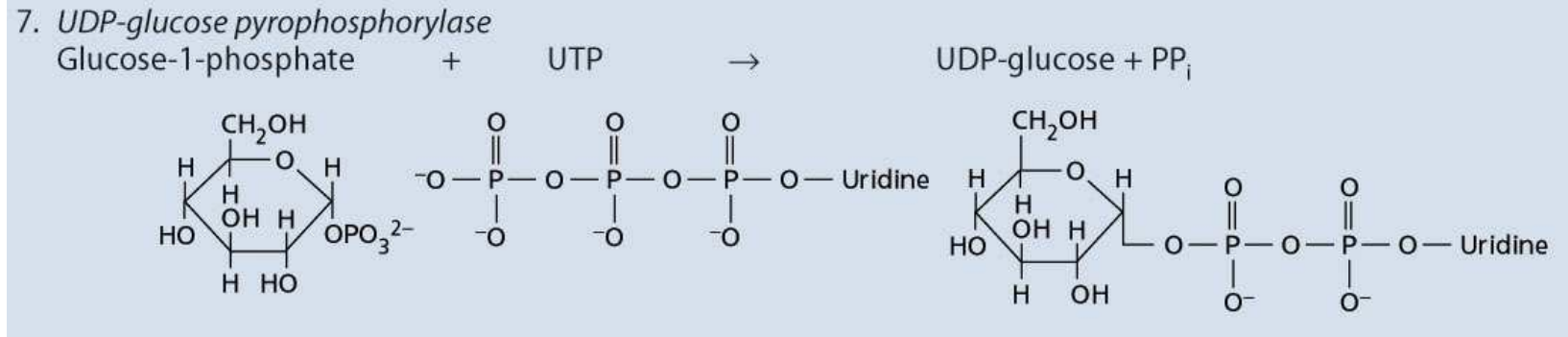
→

UDP-glucose + PP_i



UDP-glucosio

formazione dell'UDP-glucosio



$$\Delta G^\circ = -2,88 \text{ kJ/mol}$$



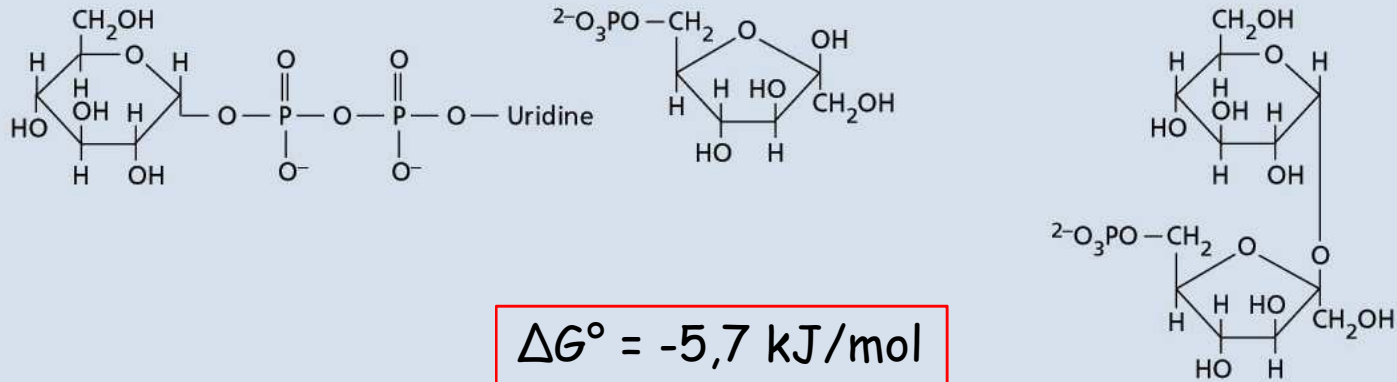
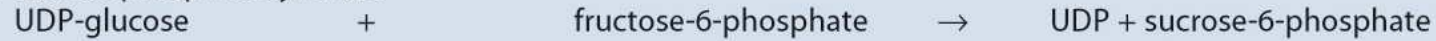
Reazione vicino all'equilibrio

Lo spostamento dell'equilibrio dipende dai processi che utilizzano il PP_i

- fosfofruttochinasi PP_i-dipendente
- H⁺-ATPasi PP_i-dipendente

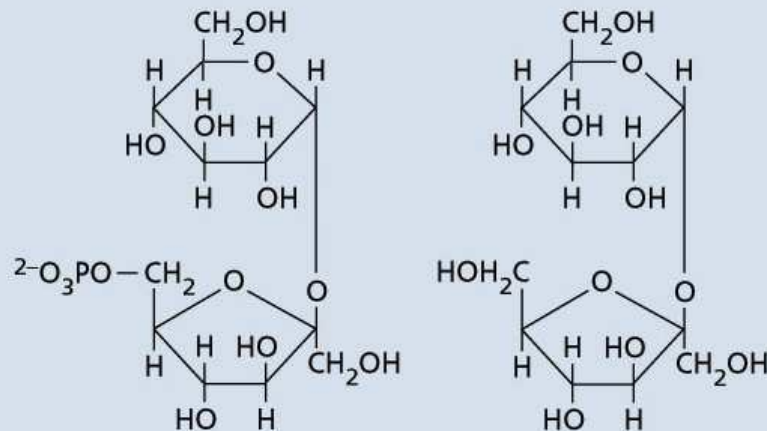
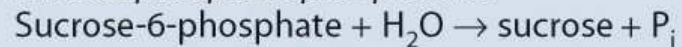
formazione del saccarosio 6-fosfato

9. *Sucrose phosphate synthase*



formazione del saccarosio

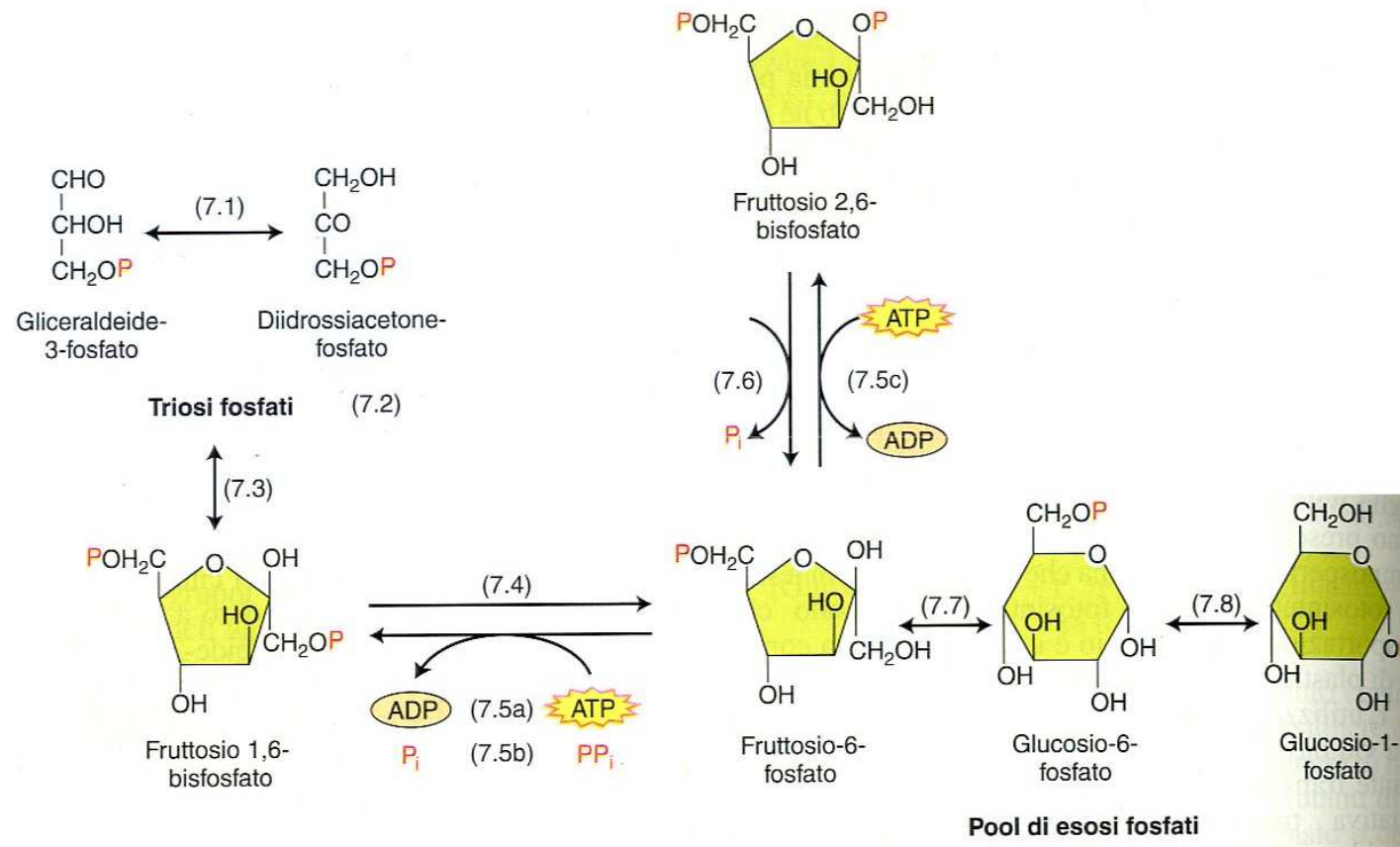
10. *Sucrose phosphate phosphatase*



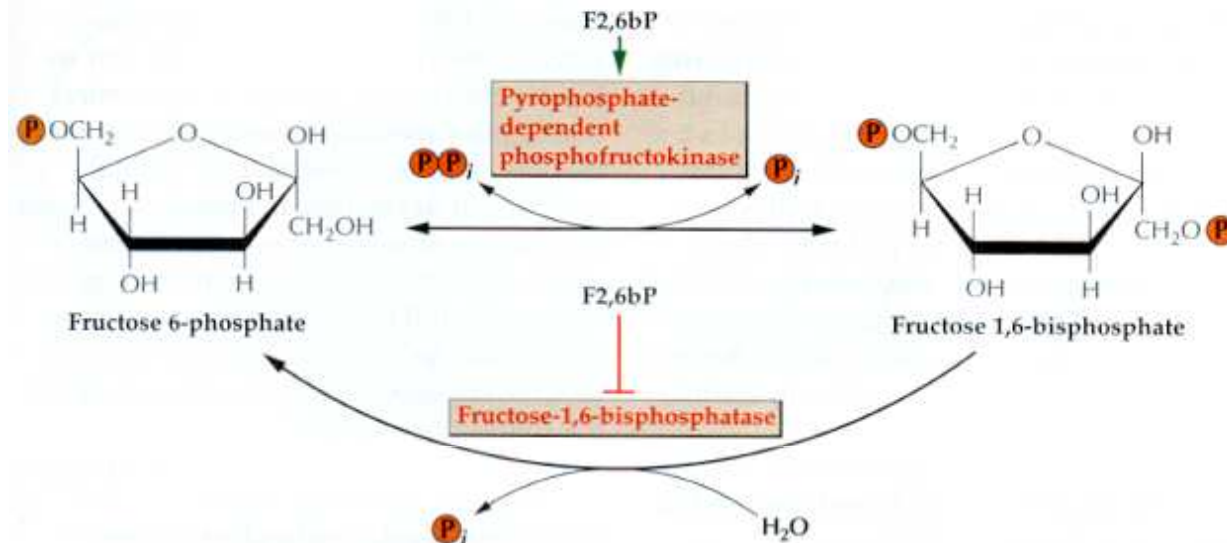
$$\Delta G^\circ = -16,5 \text{ kJ/mol}$$

REGOLAZIONE DELLA SINTESI DEL SACCAROSIO

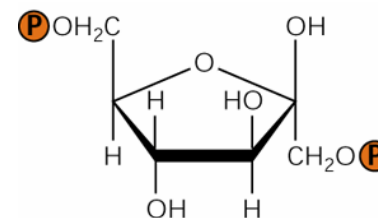
Regolazione del pool degli esosi fosfati



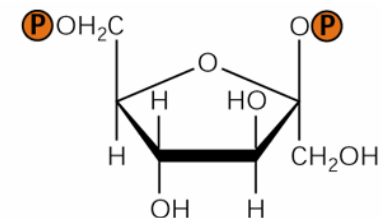
Livelli del fruttosio 6-fosfato



il **fruttosio 2,6-bisfosfato** inibisce la fruttosio 1,6-bisfosfato fosfatasi e attiva la fosfofruttochinasi



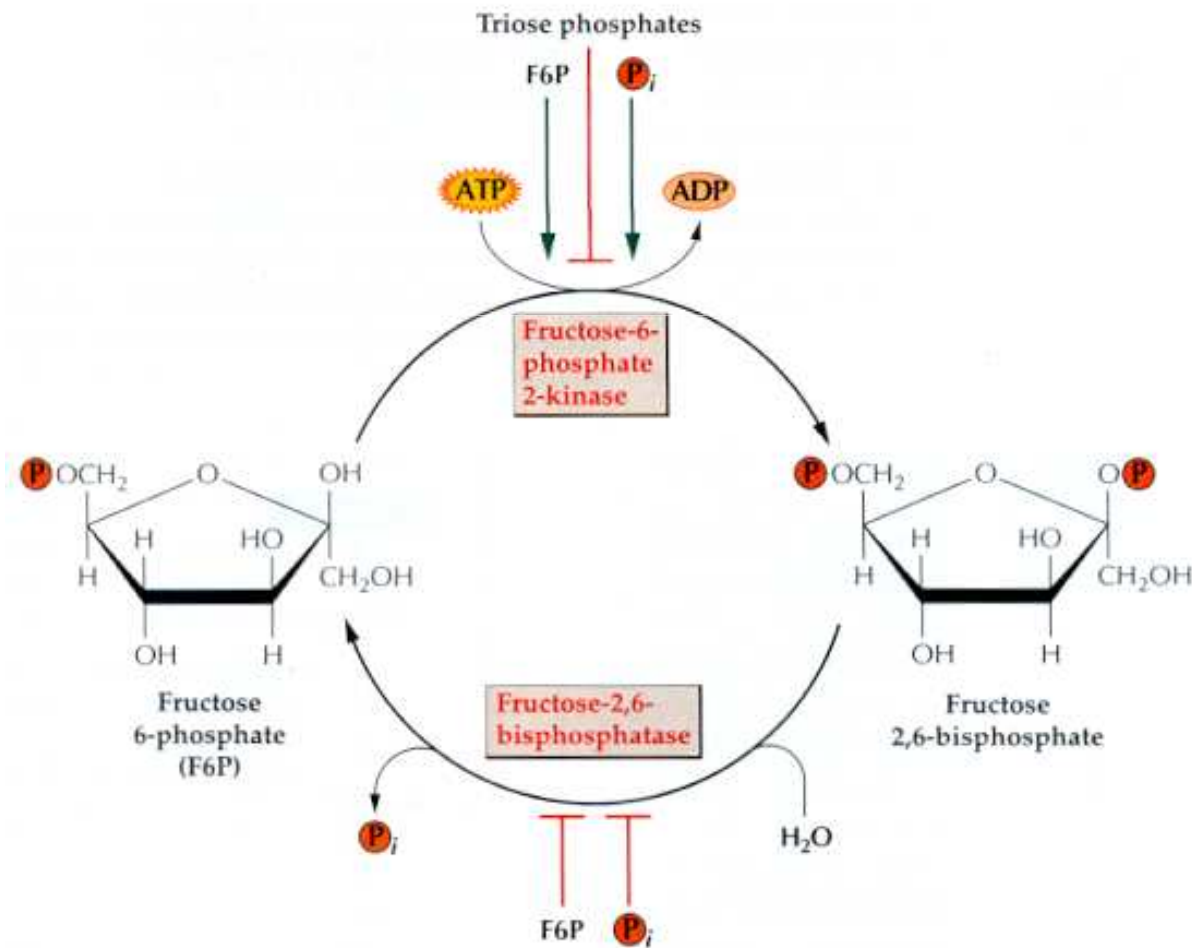
Fructose 1,6-bisphosphate, a metabolic intermediate



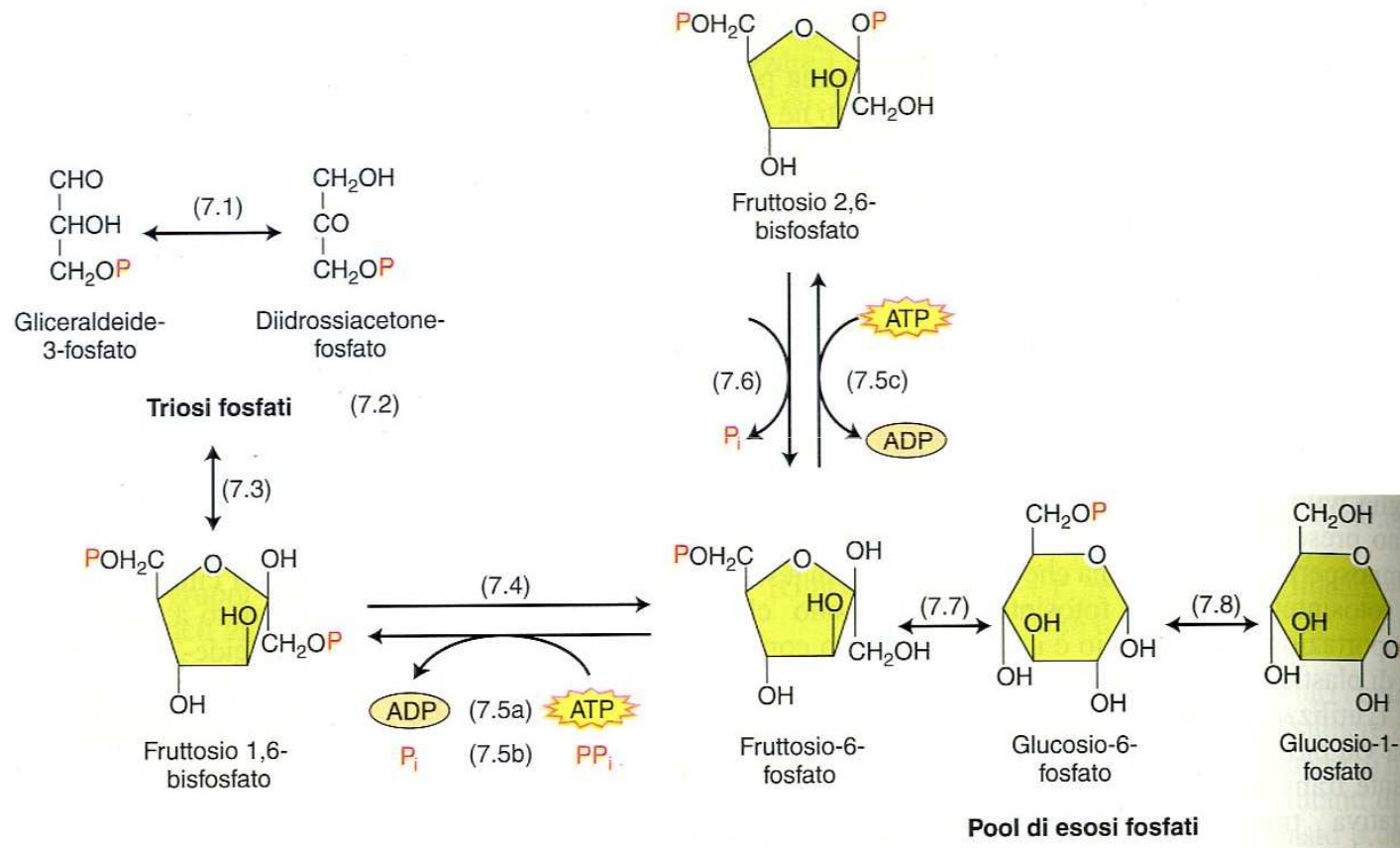
Fructose 2,6-bisphosphate, a regulatory metabolite

REGOLAZIONE DELLA SINTESI DEL SACCAROSIO

come è controllata la concentrazione citosolica del
fruttosio 2,6-bisfosfato?

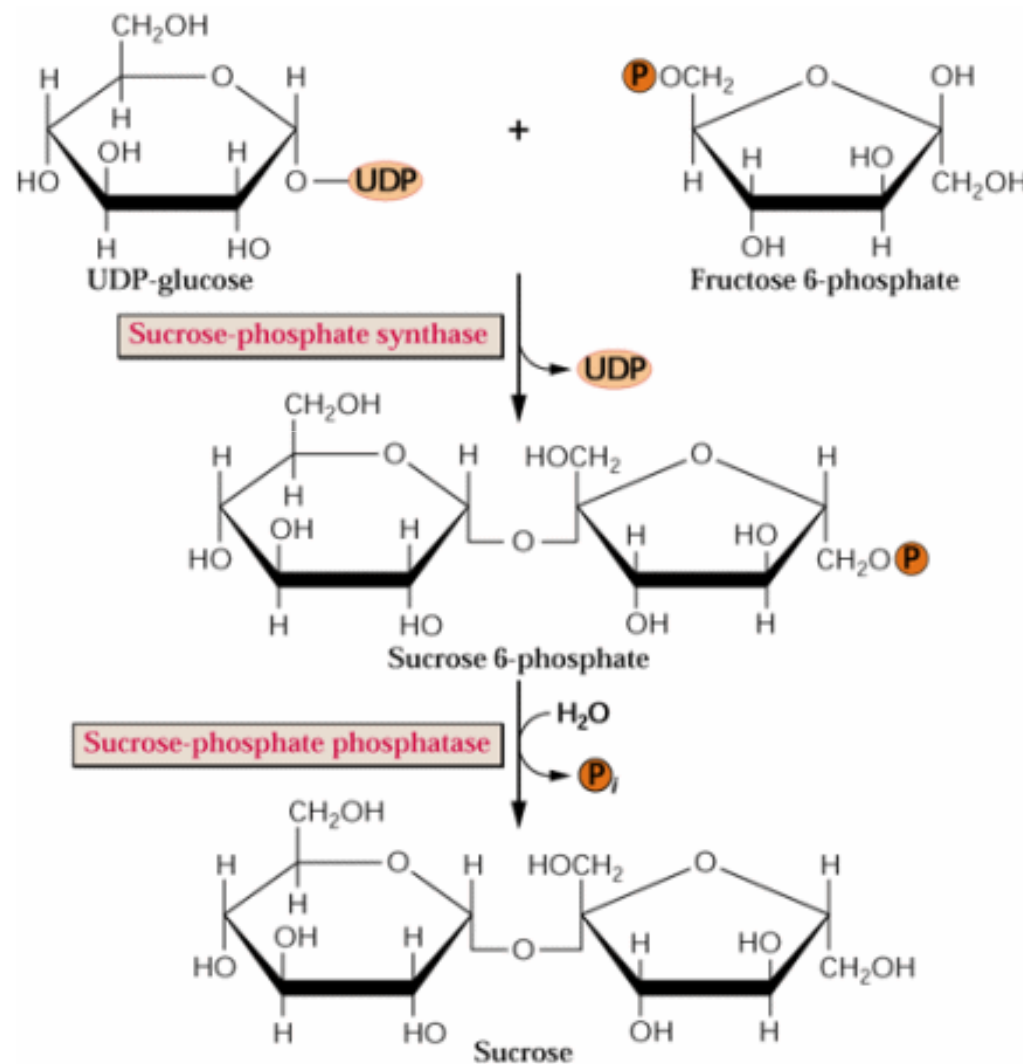


REGOLAZIONE DELLA SINTESI DEL SACCAROSIO



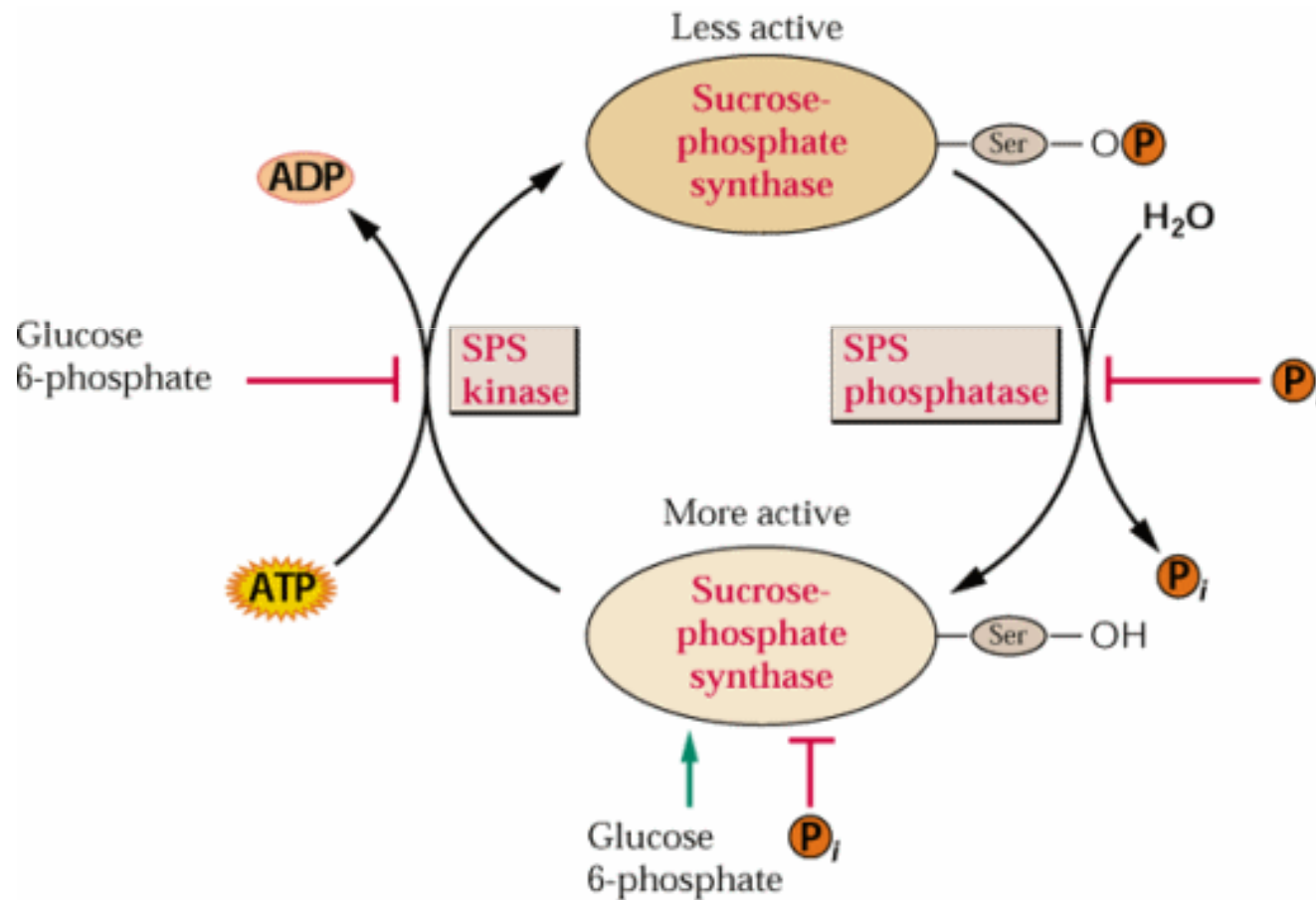
REGOLAZIONE DELLA SINTESI DEL SACCAROSIO

attività saccarosio fosfato sintasi

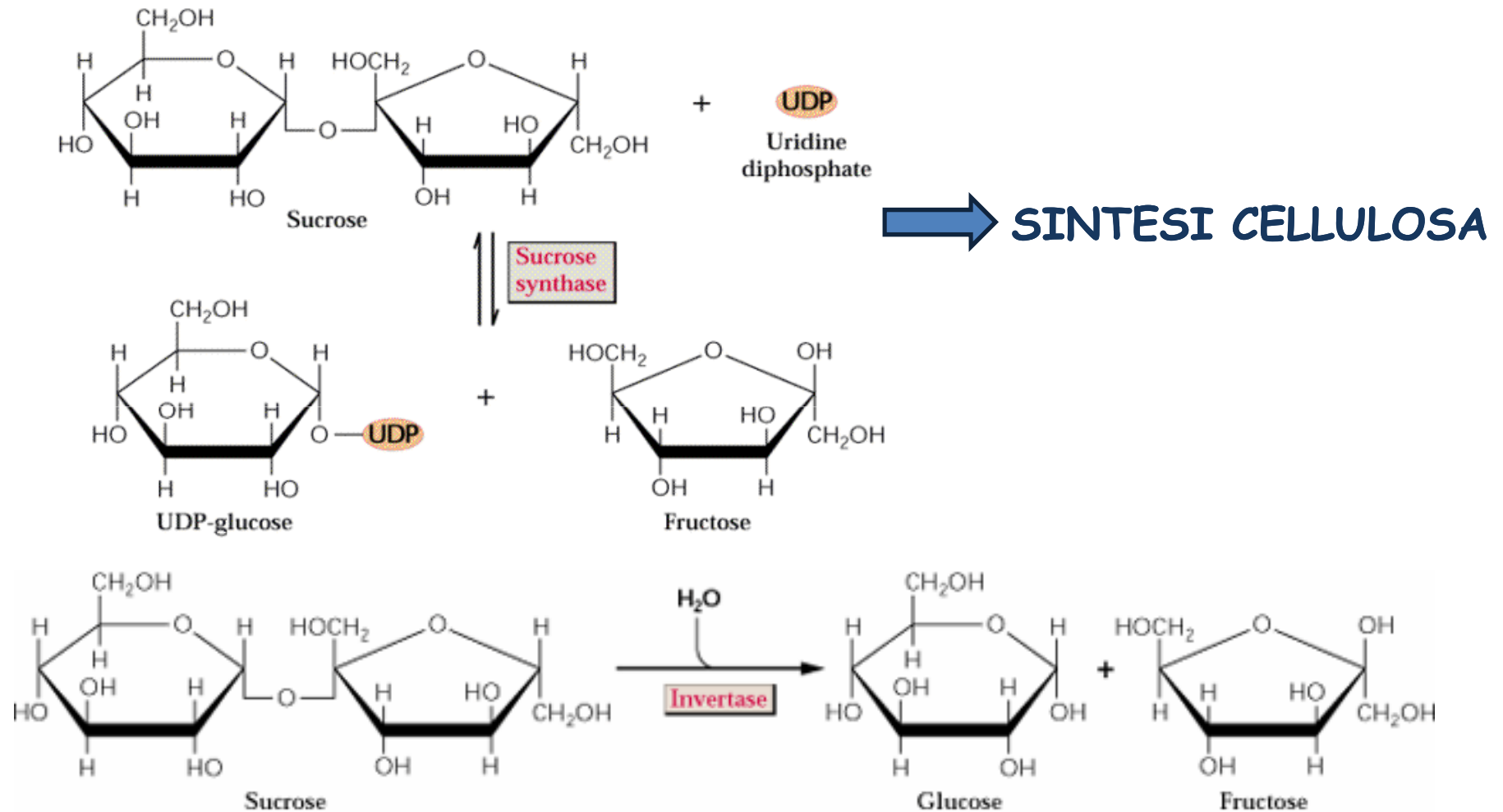


REGOLAZIONE DELLA SINTESI DEL SACCAROSIO

Regolazione dell'attività della saccarosio fosfato sintasi



DEGRADAZIONE DEL SACCAROSIO

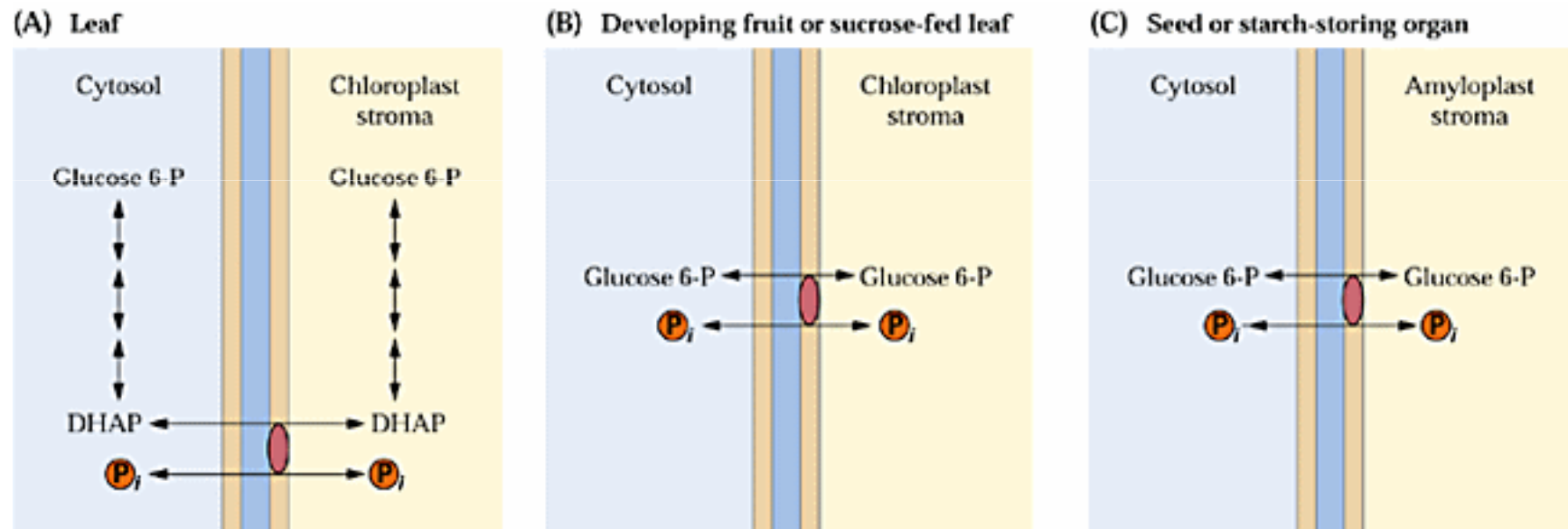


➡ SINTESI CELLULOSA

↪ SCARICAMENTO FLOEMA

sintesi dell'amido

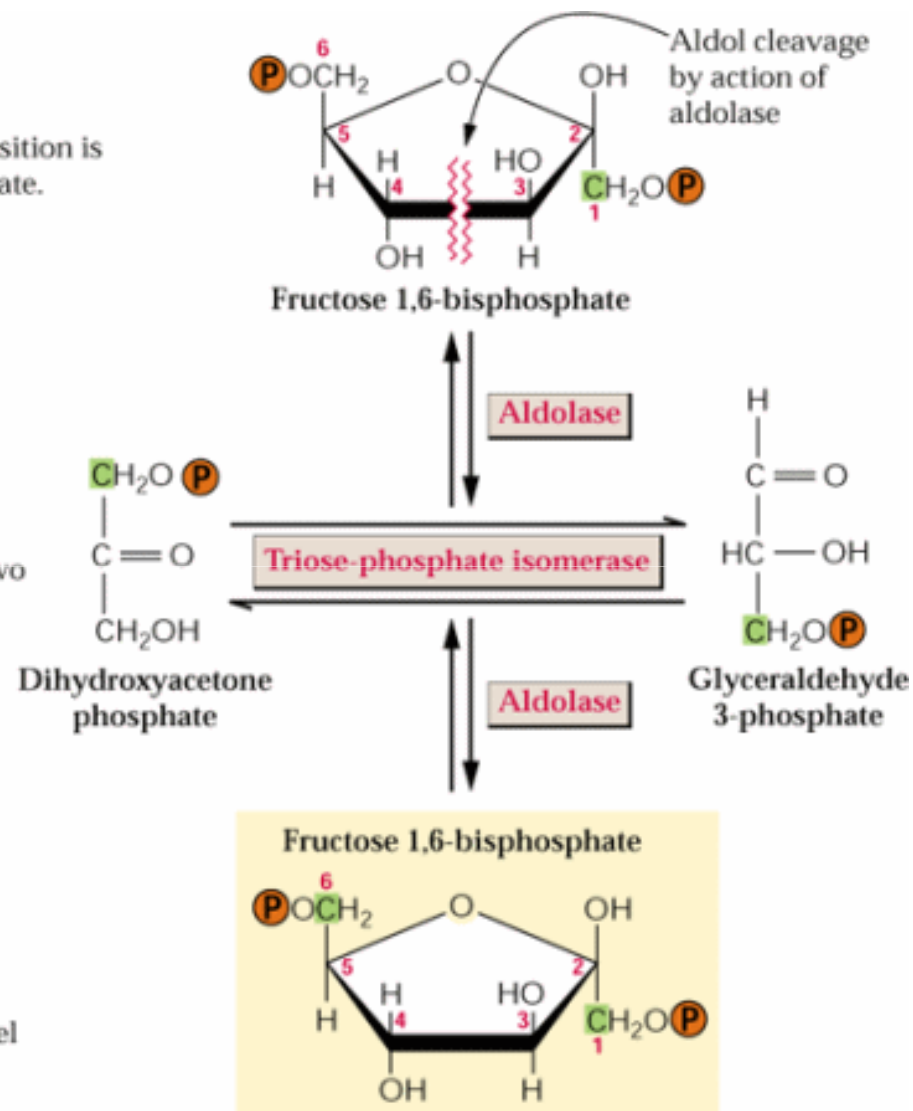
L'amido è sintetizzato a partire dal glucosio 6-fosfato



F1,6bP with label in C-1 position is starting substrate.

Label is randomized between the two trioses by TPI.

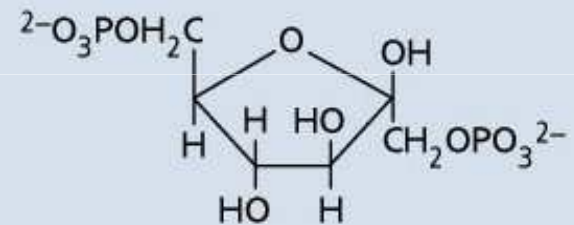
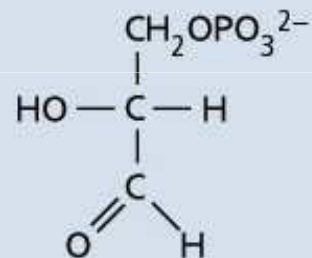
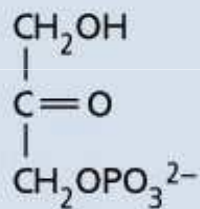
Resynthesized F1,6bP has label in C-1 and C-6 positions.



formazione del fruttosio 1,6-bisfosfato

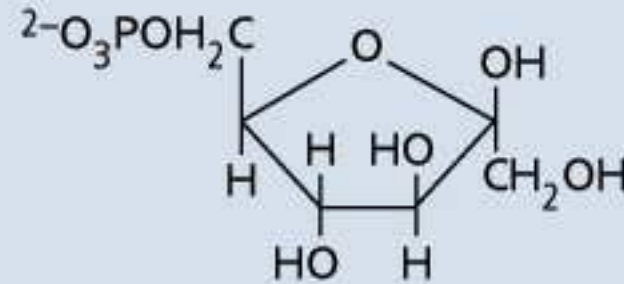
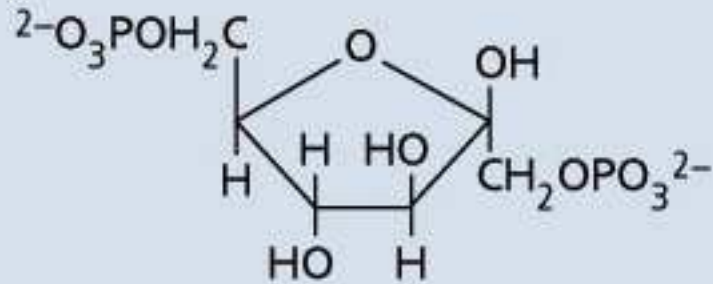
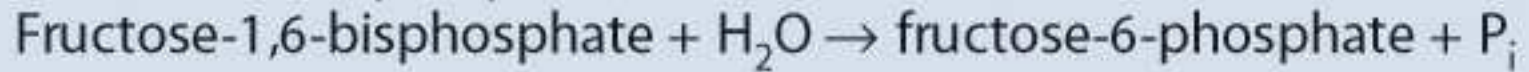
1. *Fructose-1,6-bisphosphate aldolase*

Dihydroxyacetone-3-phosphate + glyceraldehyde-3-phosphate → fructose-1,6-bisphosphate



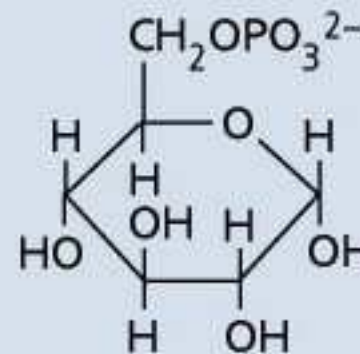
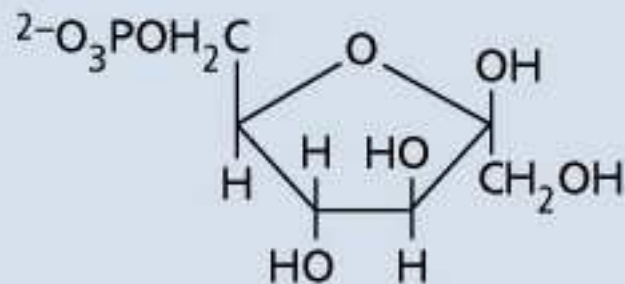
il fruttosio 1,6 bisfosfato viene convertito a fruttosio 6-fosfato

2. *Fructose-1,6-bisphosphatase*



formazione del glucosio 6-fosfato

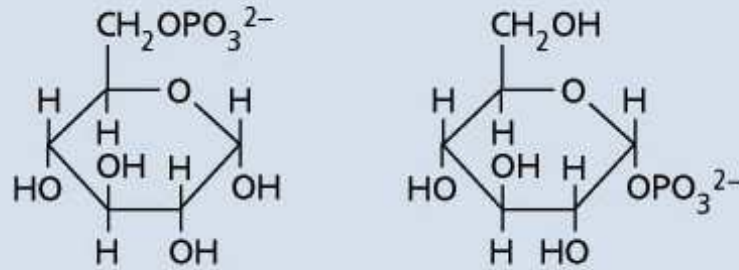
3. *Hexose phosphate isomerase*



il glucosio 6-fosfato viene convertito in glucosio 1-fosfato

4. *Phosphoglucomutase*

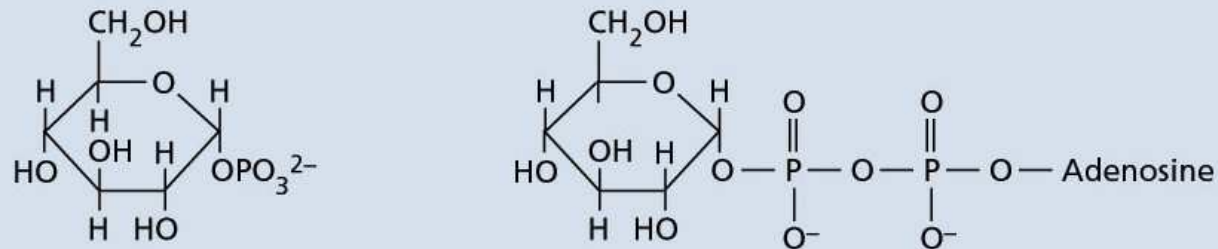
Glucose-6-phosphate $\rightarrow$ glucose-1-phosphate



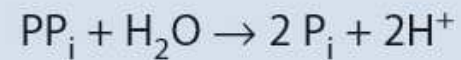
formazione dell'ADP-glucosio

5. *ADP-glucose pyrophosphorylase*

Glucose-1-phosphate + ATP $\rightarrow$ ADP-glucose + PP_i

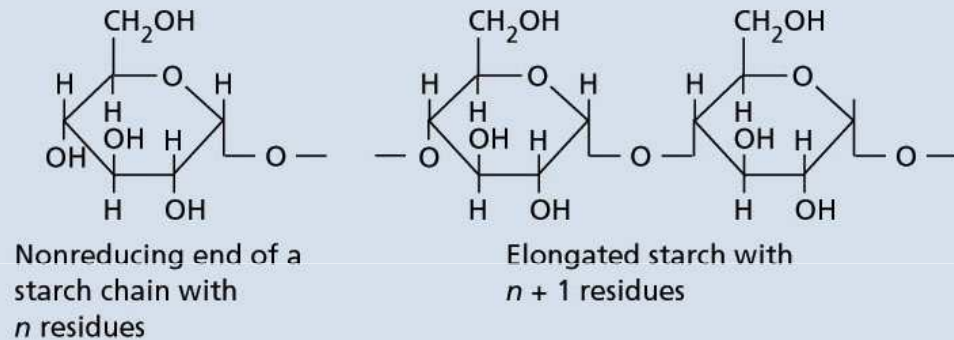
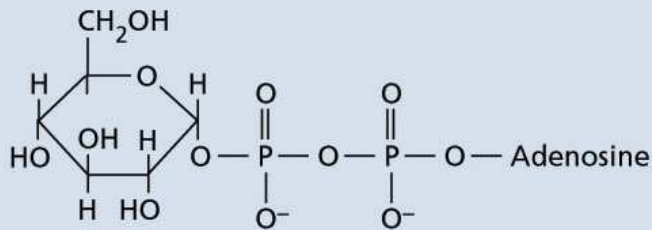
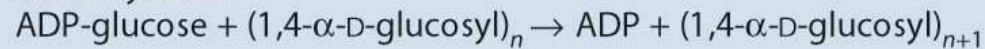


6. *Pyrophosphatase*



l'ADP-glucosio reagisce con l'estremità non riducente di una catena di amido

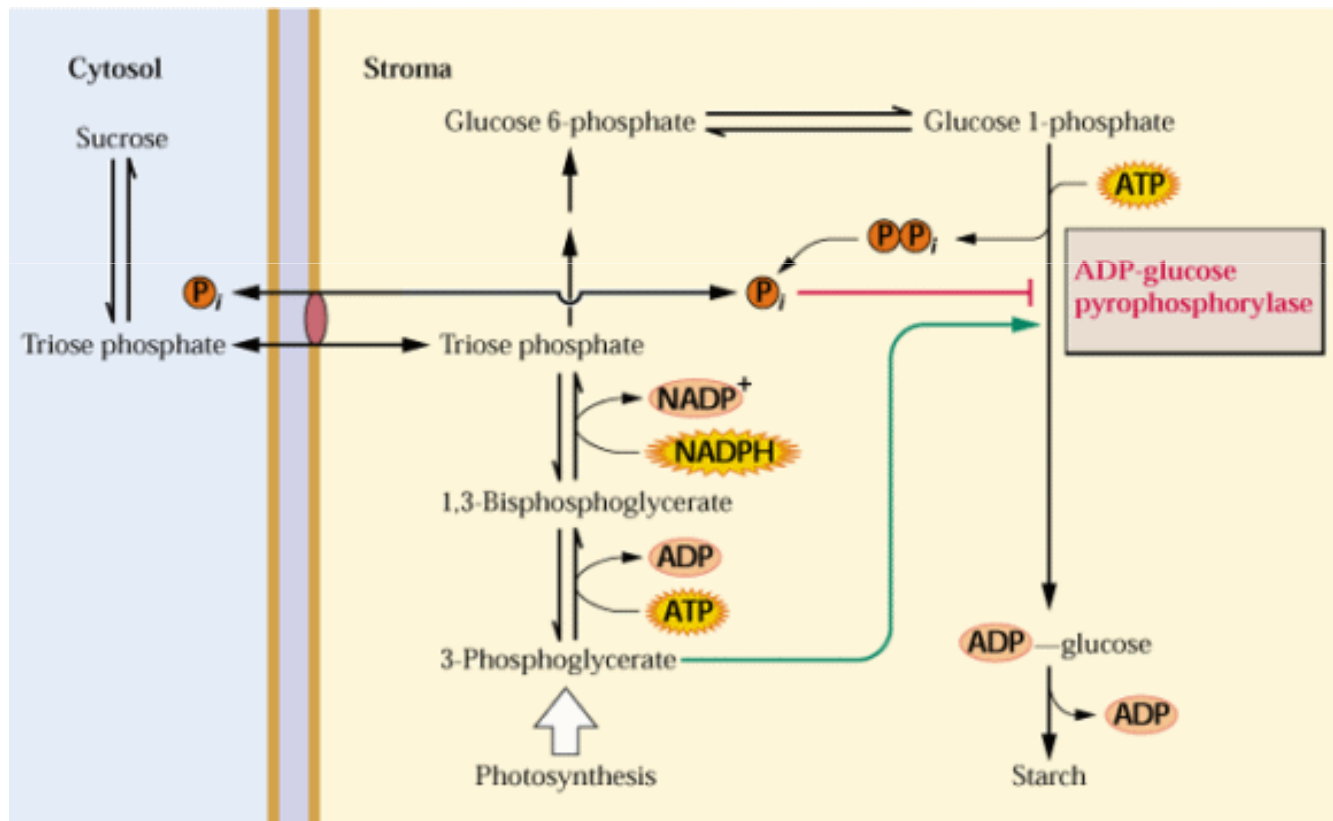
7. Starch synthase



nella sintesi dell'amilopectina è coinvolto anche l'enzima ramificante che trasferisce una catena di α -1,4-glucano sul C6 di un residuo di glucosio presente nella stessa catena

la sintesi dell'amido è regolata dall'ADP-glucosio pirofosforilasi

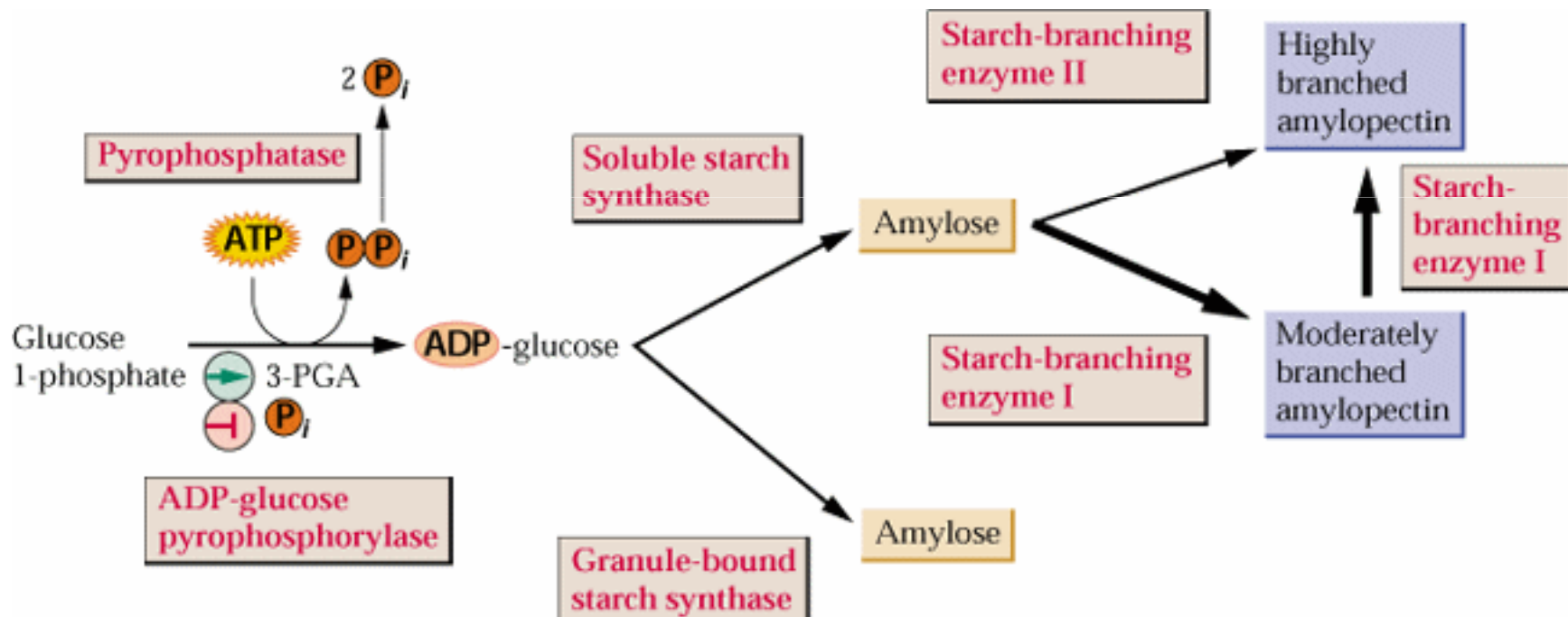
attivato da 3-fosfoglicerato
inibito da P_i



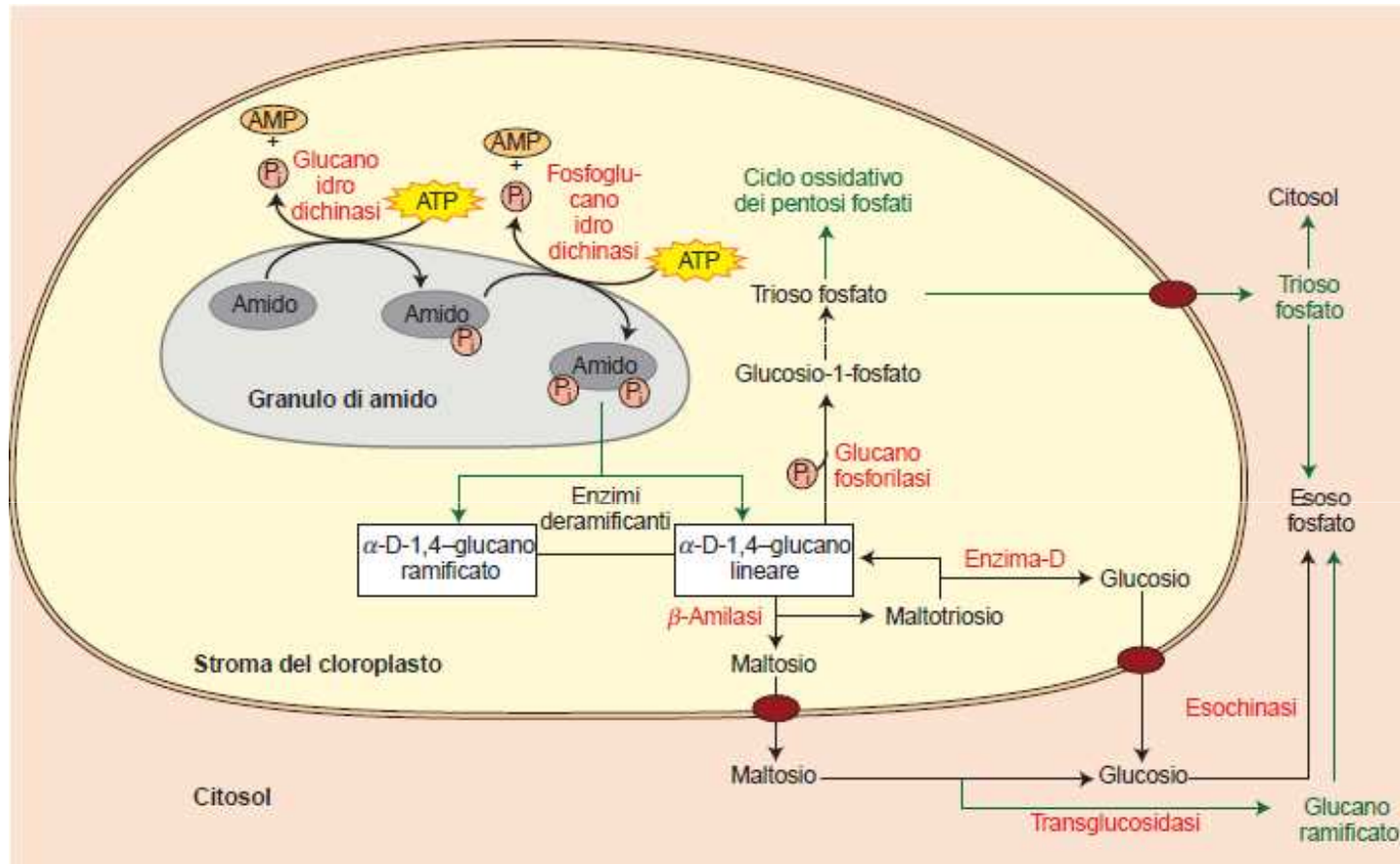
La sintesi dell'amido
dipende dal rapporto
 P_i /3-fosfoglicerato

sintesi dell'amilopectina

Esistono diversi tipi di **amido sintasi**



DEGRADAZIONE DELL'AMIDO



Idrolisi - **β-amilasi**: $[Glucosio]_n + H_2O \longrightarrow [Glucosio]_{n-2} + \text{maltosio}$

Fosforolisi - **glucano-fosfoidrolasi**: $[Glucosio]_n + P_i \longrightarrow [Glucosio]_{n-1} + \text{glucosio 1-fosfato}$

I piselli di Mendel



**Mutazione dell'enzima
di ramificazione II**



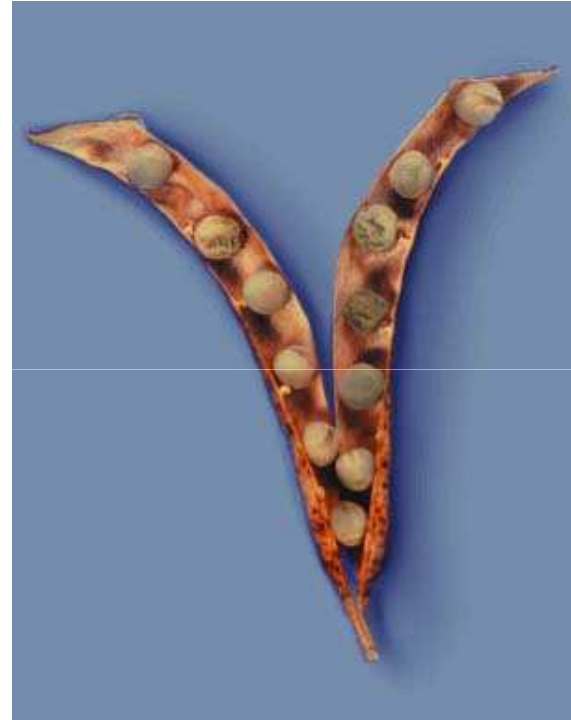
**- 30% amido
+ saccarosio**



↓ pot. osmotico



richiamo acqua



regolazione sintesi amido-saccarosio

inizio periodo luminoso



durante il giorno

**regolazione sintesi
amido-saccarosio**

**velocità produzione fotosintati >
velocità esportazione saccarosio**

citosol

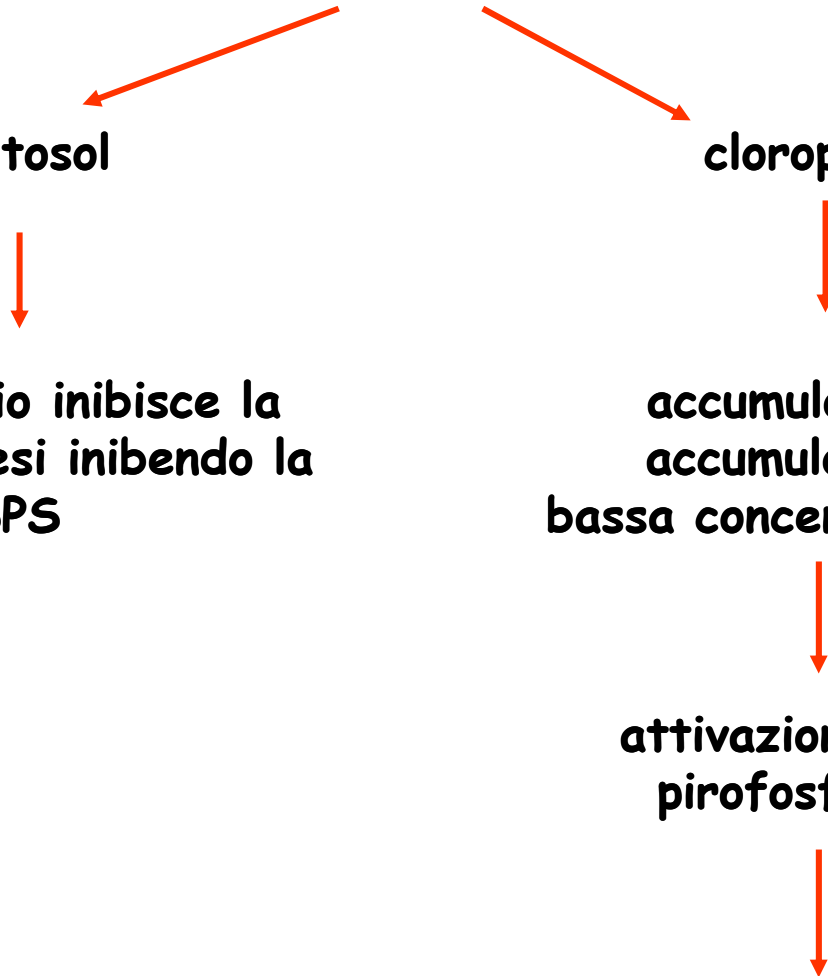
cloroplasto

**il saccarosio inibisce la
propria sintesi inibendo la
SPS**

**accumulo triosi
accumulo 3PGA
bassa concentrazione P_i**

**attivazione ADP-
pirofosforilasi**

sintesi amido



al tramonto

**regolazione sintesi
amido-saccarosio**

diminuisce la fotosintesi



diminuisce il 3-
fosfoglicerato



si inibisce l'ADP-glucosio
pirofosforilasi



arresto sintesi amido



i trioso fosfati vengono
traslocati nel citosol



inibizione sintesi fruttosio 2,6-
bisfosfato



sintesi saccarosio