Metabolite-mediated catalyst conversion of PFK and PFP: can PFK really be converted to PFP?

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It has been suggested that in spinach leaves an enzyme able to catalyze the phosphorylation of fructose 6-phosphate to fructose 1,6-bisphosphate can exist in two different interconvertible forms which use ATP and pyrophosphate respectively as phosphoryl donors [FEBS Letters 169 (1984) 287–292]. However, the data presented to support this suggestion could also be interpreted without assuming such an unusual type of interconversion. This reinterpretation considers that PFK and PFP are two distinct enzymes which are differentially activated by incubation with various effectors such as UDPG, pyrophosphate, ATP, fructose 6-phosphate and fructose 2,6-bisphosphate.

Phosphofructokinase *Pyrophosphate-phosphotransferase* *Interconversion* *Fructose 2,6-bisphosphate*

In green plants the phosphorylation of fructose 6 phosphate to give fructose 1,6-bisphosphate can be catalyzed by two different enzymes: a phosphofructokinase (PFK) which uses ATP as phosphoryl donor and a phosphotransferase (PFP) which utilizes pyrophosphate. It has recently been suggested that one type of activity may be transformed into the other, that is, that a reversible conversion between the two enzymes occurs [1]. The idea is very provocative, however, taking into account the fact that such an interconversion would be quite unusual, it is important to ascertain that the results presented cannot be interpreted in a more conservative way. The data given in tables 1 and 2 of [1] show that when partially purified preparations of PFK and PFP are incubated with different combinations of metabolites, the proportion of total phosphorylating activity which corresponds to PFK and PFP shows marked changes. From this the authors concluded that PFK and PFP were interconvertible. However, if the actual activities are given instead of the percent activities (tables 1 and 2), it can be seen that the partially purified preparation of PFK contains some PFP which is activated up to 7-fold by incubation with UDPG and PP_i while PFK activity remains constant. The PFP preparation in turn contains some PFK which can be activated up to 13-fold by incubation with $F2,6P_2$ and F6P and up to 10-fold when F6P is replaced by ATP. In these conditions PFP activity is also activated but to a lesser extent, 2–3-fold depending on the metabolites present in the incubation medium.

Taking these data into account it does not appear warranted to postulate an interconversion between the two enzymatic activities. The conclusion that can be safely drawn is that PFK and PFP from spinach leaves are differentially activated by

Table 1

Effect of preincubation with metabolites of a preparation of leaf cytosolic PFK

Preincubation treatment	PFK (nmol/min per mg protein[a])	PFP
Control	153	23
UDPG	159	98
PP_i	151	35
UDPG + PP_i	161	161

[a] Calculated from the data on % of total PFK + PFP activity and actual total activities from table 1 of [1]

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Table 2

Effect of preincubation with metabolites of a preparation of leaf PFP

Preincubation treatment	PFP (nmol/min per mg protein[a])	PFK
Control	116	14
$F2,6P_2$	335	87
ATP	114	73
F6P	144	86
$F2,6P_2$ + ATP	310	145
$F2,6P_2$ + F6P	264	186

[a] Calculated from the data on % of total PFP + PFK activity and actual total activities from table 2 of [1]

various metabolites and that these differences can allow a flexible response to the changing metabolic needs of the cells.

REFERENCES

[1] Balogh, A., Wong, J.H., Wötzel, C., Soll, J., Cséke, C. and Buchanan, B.B. (1984) FEBS Lett. 169, 287–292.