

ROLE OF THE r GENE IN PLASTID INSERTION OF PHOSPHORYLASES

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A recent publication by Steup and Latzko (Planta 145:69-75, 1979) reports three electrophoretically separable forms of starch phosphorylase in 'Kleine Rheinlanderin' pea leaves. Two forms appear to be bound within chloroplasts, while the third is not. Though my studies of pea leaf phosphorylases have been very limited and have not included the Klein Rheinlanderin variety, I have detected significant amounts of extra-chloroplast phosphorylase only in r varieties. I have assumed that the same "block" in phosphorylase insertion which seems to operate for r cotyledon amyloplasts (see PNL 11:36-37) might also operate for leaf chloroplasts. Regardless, a word of caution about using electrophoretic migration rates in phosphorylase studies is in order. In my hands, banding pattern for phosphorylases varies with the amount and source of starch present in the extract, with R vs r genotype, and with strain (loci other than r?).

Interpretation of the role of the r gene in plastid insertion of phosphorylase would be easier if the primary site of r gene action were known. Influence of the r gene on phosphorylase II electrophoretic migration rate (see PNL 11:36) strongly indicates it is the "structural gene" for phosphorylase II. However, I have found an apparently non-allelic gene in the strain 'Dwarf Grey Sugar' which seems to modify the electrophoretic mobility of phosphorylase II in both R and r genotypes. The r gene also modifies the quantitative level of both phosphorylase I and II (see Matheson and Richardson, Phytochem. 16:1875-1876, 1977). Obviously, more work is needed before the primary site of r gene action is known.

The preceding notwithstanding, electrophoretic patterns of extracts from developing or mature heterozygous R/r cotyledons definitely indicate the existence of a "triplet band" corresponding to R/R and r/r homodimers plus a more prevalent R/r heterodimer of phosphorylase II. Furthermore, a considerable portion of the R/r heterodimer but almost none of the r/r homodimer is found within the amyloplasts. This would seem to indicate either that r monomer can cross the amyloplast envelope when dimerized with an R monomer but not when dimerized with an r monomer, or that R-dependent modification of phosphorylase II monomer occurs in a dose-related manner during amyloplast envelope transport.