enzyme. Further analysis of the detailed kinetics by the stopped-flow technique revealed that the observed species was a ternary complex of O_2 , the enzyme and tryptophan, an oxygenated form of the enzyme and an obligatory intermediate in the reaction (Ishimura *et al.*, 1971). The following reaction mechanism was therefore compatible with the above data: the ferrous form of the enzyme first combines with tryptophan and then reacts with O_2 to form an oxygenated intermediate, degradation of which is the rate-limiting step of the overall reaction. This reaction mechanism is consistent with the view that dioxygenase reactions in general involve a ternary complex of enzyme, O_2 and organic substrate (Nozaki *et al.*, 1968). A similar oxygenated intermediate has been demonstrated with protocatechuate 3,4-dioxygenase, a non-haem-iron-containing dioxygenase (Fujisawa *et al.*, 1971).

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Biosynthesis of Flavonoid Compounds: Enzyme Activities in Relation to Cell Growth and Differentiation

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Synthesis and degradation of secondary plant products can often be directly related to growth and development of certain organs or to processes of differentiation of special types of cells. One of the most widespread groups of secondary plant metabolites is that of flavonoid compounds. Most of the general aspects of their biosynthesis have been elucidated by feeding experiments with labelled precursors (Grisebach, 1968). Recently the relationship between organ development in young parsley plants and changes in the accumulation of flavone glycosides and in the activities of some of the enzymes related to their biosynthesis has been studied. As a result of these investigations, a high degree of correlation

between development of cotyledons and leaves and activities of enzymes involved in the formation of flavone glycosides was demonstrated (Hahlbrock *et al.*, 1971).

For experimental reasons more detailed studies on the relationship between cell differentiation, accumulation of flavonoid compounds and activities of the enzymes related to this biosynthetic pathway were carried out with cells grown in suspension culture. In contrast with parsley plants, cells grown in the dark in liquid medium (containing mineral salts, vitamins, sucrose and 2,4-dichlorophenoxyacetic acid) did not produce flavone glycosides. Induction of enzymes and subsequent formation of flavone glycosides were taken as an expression of cell differentiation and were initiated by treatment of dark-grown cultures with light (Hahlbrock & Wellmann, 1970).

All of the enzymes investigated exhibit a high degree of correlation with regard to changes in their activities during the initial stages of flavonoid biosynthesis. However, two groups of enzymes could be distinguished by the time-lag before reaching maximum activity. Group I consists of the three enzymes acting on substrates of the phenylpropanoid type (phenylalanine ammonia-lyase, cinnamate 4-hydroxylase and *p*-coumarate-CoA ligase), whereas group II comprises all those enzymes related exclusively to the formation of flavonoid compounds and their glycosides (chalcone-flavanone isomerase, UDP-glucose-flavone 7-*O*-glucosyltransferase, UDP-apiiose, flavone-7-*O*-glucoside apiosyltransferase, UDP-apiiose synthetase and *S*-adenosylmethionine-luteolin 3'-*O*-methyltransferase).

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Role of Indol-3-ylacetic Acid in the Induction of Enzymes during Seed Germination

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Biochemical morphogenesis has not attracted the same degree of attention in plants as in animals or in unicellular micro-organisms, notwithstanding the dramatic changes in the growth of plant tissues that occur under the influence of plant hormones. Differentiated single cells cultured in chemically defined media would be the ideal system for the study of the regulation of biosynthesis in plants. However, investigations with whole germinating seeds can also be considered as a practical approach for elucidating the