may implicate this type of metabolite as suggested by Clayson, Jull & Bonser (1958) and Boyland (1963).

M. J. C. acknowledges the award of a Research Studentship.

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Mercapturic Acid Formation from Allyl Compounds in the Rat

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In an earlier investigation (Clapp, Kaye & Young, 1969) the urine of rats that had been injected subcutaneously with allyl chloride was shown to contain allylmercapturic acid, i.e. *N*-acetyl-*S*-allyl-L-cysteine, together with 3-hydroxypropylmercapturic acid, i.e. *N*-acetyl-*S*-(3-hydroxypropyl)-L-cysteine. Examination of the urines of rats that had been dosed with allyl alcohol and with allyl acetate revealed that they contained 3-hydroxypropylmercapturic acid, but no evidence was found for the presence of allylmercapturic acid.

In the present work allylmercapturic acid was isolated from the urine of rats dosed with *S*-allyl-L-cysteine in an amount corresponding to 16.3% of the injected compound and was also shown to be excreted by rats after the injection of allyl bromide and allyl iodide. It was also possible to isolate crotylmercapturic acid from the urine of rats injected with crotyl chloride.

A further study of the metabolism of allyl alcohol led to the isolation of 3-hydroxypropylmercapturic acid as its dicyclohexylammonium salt from the urine of the dosed rats in an amount that represented 6.3% of the administered alcohol. No evidence was obtained for the excretion of allylmercapturic acid by these animals. As had been reported earlier for allyl acetate, other carboxylic acid esters of allyl alcohol, namely allyl propionate, allyl stearate and allyl benzoate, were found in the present work to give rise to formation of 3-hydroxypropylmercapturic acid, but not to allylmercapturic acid.

Some esters of allyl alcohol do give rise to the biosynthesis of allylmercapturic acid, however, for

it was found that from the urine excreted in the 24 h period after injection of triallyl phosphate into rats it was possible to isolate allylmercapturic acid in an amount corresponding to 3.9% of the administered compound. In a similar experiment in which sodium allyl sulphate was injected into rats allylmercapturic acid corresponding to 4.0% of the administered compound was isolated from the urine. It is noteworthy that two other sulphates, namely sodium benzyl sulphate and sodium 1-menaphthyl sulphate, have recently been shown to give rise to formation of benzylmercapturic acid and 1-menaphthylmercapturic acid in rats (Gillham, Clapp, Morrison & Young, 1970).

These various observations were discussed in the light of current views concerning the mechanism for the biosynthesis of mercapturic acids.

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The Induction of Hepatic Microsomal Enzymes by Safrole

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It is well known that administration of a number of drugs and other nutrient chemicals to animals may result in hypertrophy of the liver and an increase in the activities of various hepatic enzymes (Conney, 1967). This has also been shown to occur with certain natural nutrients, e.g. β -ionone, which, as other terpenoids, gives rise to induction of the hepatic microsomal drug-metabolizing enzymes (Parke & Rahman, 1969). Certain methylenedioxyaryl pesticides, inhibitors of the hepatic microsomal oxygenases, stimulate the rat hepatic microsomal enzymes that catalyse the 2-hydroxylation of biphenyl but inhibit those that catalyse the 4-hydroxylation of this substrate (Jaffe, Fujii, Guerin, Sengupta & Epstein, 1969).

Safrole (4-allyl-1,2-methylenedioxybenzene), an nutrient that occurs naturally in many essential oils, e.g. sassafras, and is present in the flavourings of root beer and sarsaparilla, has now been shown to produce in the rat liver hypertrophy accompanied by marked increases in a number of the hepatic microsomal enzymes including biphenyl hydroxylase, nitro reductase, glucuronyltransferase and cytochrome *P*-450. The addition of safrole to rat liver microsomal preparation *in vitro* did not result in any similar increase in enzyme activities. The increase in activity of biphenyl 4-hydroxylase,