fractions sedimenting at less than 200 000g, but by using a more gentle homogenization method and the classical isolation methods of Palade & Siekevitz (1956) a microsomal fraction was obtained containing 60–70% of the δ -tocopherol. Ribosomes were separated from this fraction by solubilization of the membranous parts with 0.3% deoxycholate followed by recentrifugation to yield a ribosomal pellet. δ -Tocopherol was not in the ribosomal fraction. Of the δ -tocopherol not in the microsomal fraction (i.e. in the 'soluble' part of the cell) some could be precipitated with proteins by ammonium sulphate, and passage of the soluble fraction through Sephadex G-75 yielded δ -tocopherol in two protein-containing fractions.

Clearly α -, γ - and δ -tocopherols are separated from one another in the cell and, although the precise localization is not yet known in each case, it is hoped that these studies will throw some light on the interrelationships and functions of the tocopherols.

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The Uptake and Utilization of β -Tocopherol by Higher Plants and Algae.

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γ -Tocopherol (7,8-dimethyltocol) has been suggested as a possible precursor of α -tocopherol (5,7,8-trimethyltocol) in some plant tissues (Whistance & Threlfall, 1968). Other plants contain β -tocopherol (5,8-dimethyltocol) and α -tocopherol, and we have investigated the biosynthetic relationship between these two by using labelled β -tocopherol.

[5-Me- 14 C] β -Tocopherol was prepared by chloromethylation of δ -tocopherol with [14 C]paraformaldehyde and hydrochloric acid followed by reduction, and was taken up by shoots of wheat (3 days old) and barley (9 days old) in diluted Tween 20 or was incubated with thallus tissue of *Fucus spiralis* or cells of *Anabaena variabilis*. All these tissues have been reported to contain β -tocopherol (Brown, 1953; Green, 1958; Pows & Redfearn, 1967). The lipids were extracted and fractionated by t.l.c. and

assayed for radioactivity by scintillation counting or radioautography.

Very small amounts of radioactivity (about 100 c.p.m., 0.0002% of the administered β -tocopherol) were found in α -tocopherol in wheat and *A. variabilis*, and no radioactivity in barley and *F. spiralis*. However, seven relatively highly labelled compounds were detected, with the following by R_F values in chloroform and 18% (v/v) diethyl ether in light petroleum respectively: compound (I), 0.44 and 0.43; compound (II), 0.87 and 0.93; compound (III), 0.78 and 0.84; compound (IV), 0.70 and 0.71; compound (V), 0.67 and 0.27; compound (VI), 0.55 and 0.20; compound (VII), 0.40 and 0.15. *Fucus* contained only compound (I), which proved to be β -tocopherol; wheat and barley showed all seven, and *A. variabilis* all but compounds (II) and (VI). Compound (VII) was identified as β -tocopherolquinone, and to investigate the identities of the other materials the various dimers and trimers formed on oxidation of β -tocopherol (Nilsson, Daves & Folkers, 1968) were made for comparison. Fraction (IV) was found to migrate with synthetic diphenyl ether dimer, but although compound (VI) had chromatographic properties approximating to those of the biphenyl dimer they could be distinguished.

Unlabelled β -tocopherol (10mg) was given to barley shoots or *A. variabilis* and 0.5mg quantities of compound (III) were isolated in each case. This material proved to be identical with an as yet undescribed product of ferricyanide oxidation of β -tocopherol. Physicochemical studies (u.v., i.r., n.m.r., mass spectrometry, t.l.c. and nitrosation) suggest that the compound is a dimer with a link between the 5-methyl group of one molecule and the 5-position of the other. Rearrangement of the second ring involves formation of a dienone system.

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