

others than intended agriculturists. If our university departments of agriculture would open their doors wider and offer courses for laymen as well as for agriculturists, and regard such courses as equally important, the ultimate development of a 'land interest' would surely be considerable. If men and women who are destined to teach in our schools or to take a part in public affairs had the opportunity to read agriculture during a university course, the ultimate indirect effect on our national agriculture might be as great as the present direct effect of agricultural education.

So far as its direct influence on farming practice is concerned, agricultural education is normally associated with some such phrase as "the application of science to farming." When, however, one considers the two great groups of factors which alone can create or alter an economic condition—scientific facts and philosophical outlook—one is left with more than a suspicion that the greater defect in our agriculture is not in science but in philosophy. Great as is the scope for bringing more scientific knowledge to the farm, the limiting factor to-day is interest in farming and in the phenomena of the farm. Without slackening its efforts to find scientific solutions of specific farm problems, agricultural education can greatly increase its service to the community by giving more attention to what after all is the essence of education, namely, the development and propagation of an interest in its subject matter.

This suggestion in no way implies a criticism of the work of those agriculturists who, for the most part, control the administration of agricultural education in Great Britain. The suggestion is rather that their work needs to be balanced by purely educational aspects of the teaching of agriculture in order that agricultural education may be developed with properly distributed emphasis and with greater usefulness to the community.

N. M. COMBER.

The University, Leeds.

The Occurrence of Ergosterol in Phytosterols.

THE interest which has been aroused by the discovery that ergosterol is converted into vitamin-D on irradiation has led us to consider its possible mode of formation in the vegetable kingdom.

In this connexion some interesting facts arise from the recent work of Bonstedt (*Zeitschr. für physiol. Chem.*, **176**, 269; 1928) on γ -sitosterol, first detected by Anderson and Shriner in corn oil (*Jour. Am. Chem. Soc.*, **48**, 2976; 1926). This investigator has prepared a number of derivatives of this sterol, and a comparison of their physical properties with those of the isomeric derivatives in the ergosterol series reveals, as shown in the following table, a remarkable similarity:

Formula.	Substance.	m.p. (α)D.	Authority.
C ₂₇ H ₄₆ O	γ -sitostanol	143.4° +21° 144.5° +18°	Bonstedt (<i>loc. cit.</i>) Anderson, Shriner (<i>loc. cit.</i>)
	allo- α -ergostanol	144.5° +16°	Reindel and Walter, <i>Annalen</i> , 460 , 212; 1928.
C ₂₉ H ₅₀ O ₂	γ -sitostanol acetate	144.5° +12°	Bonstedt.
	γ -sitostanol acetate	143° +9°	Anderson, Shriner.
	allo- α -ergostanol acetate	145° +6°	Reindel, Walter.
C ₂₇ H ₄₄ O	γ -sitostanone	163° +38°	Bonstedt.
	allo- α -ergostanone	164° ..	Reindel, Walter.
C ₂₇ H ₄₄	γ -sitostane	87° +20°	Bonstedt.
	allo- α -ergostane	84.5° +17°	Reindel, Walter.

Reindel and Walter (*loc. cit.*) have shown that there is no depression of melting-point on mixing γ -sito-

stanol acetate with allo- α -ergostanol acetate, but infer from the difference in specific rotation that the two substances are not identical. This contention we feel is open to question, for, as we have already pointed out (Heilbron, Morton, and Sexton, *Jour. Chem. Soc.*, p. 47; 1928), owing to the complex nature of the sterol molecule, the possibilities of racemisation at one or more of the asymmetric centres during the operations involved in their preparation cannot be excluded.

The common and probably general association of dihydrositosterol with sitosterol in vegetable oils (see Bonstedt, *loc. cit.*; Anderson *et alia*, *Jour. Amer. Chem. Soc.*, **48**, 2972 *et seq.*; 1926) suggests its genesis by a reduction process. Similarly, as there is every reason to believe that ergosterol is also present in all phytosterols (Heilbron, Kamm, and Morton, *Biochem. Jour.*, **21**, 1279; 1927), we venture to suggest with all reserve that concurrent with its reduction to dihydrositosterol (sitostanol), oxidation of sitosterol (possibly γ -sitosterol) to ergosterol occurs.

The fact that neither of the two known tetrahydro-ergosterols (ergostenols) is identical with the isomeric γ -sitosterol is in no way remarkable. It has been established that ergosterol contains an ethenoid linkage which resists hydrogenation under conditions which suffice to convert γ -sitosterol into the fully saturated derivative; consequently, in the conversion of ergosterol to its tetrahydro derivative, the ethenoid linkage remaining must be in a different position from that present in γ -sitosterol. The suggested identity therefore only reveals itself in the fully saturated products.

It is hoped that work which is now in progress in these laboratories may throw additional light on this important problem.

I. M. HEILBRON.

W. A. SEXTON.

The University,
Liverpool.

Transmutation of the Lighter Elements in Stars.

THE formula given by Gamow (*Zeits. f. Phys.*, **52**, p. 512; 1928), for the probability that an α -particle will penetrate the nucleus of an atom with which it collides, can be readily adapted to the case of proton-impacts. These have only half the charge of an α -particle, and for the same energy twice the velocity, so that under conditions approaching thermodynamical equilibrium they have an enormously greater penetrating-power. We have investigated the possibility that in the interior of stars the process should actually occur with appreciable frequency, and we find that for the heaviest elements the probability is extremely small. For the lightest, however, we obtain an average life varying roughly from 10 seconds for helium to 100 years for carbon in a fairly typical case. The protons that are most effective, when their number is taken into account, are those with from three to four times the most probable velocity of the Maxwell distribution.

We cannot well estimate the probability that a proton which has entered a nucleus will anchor itself there by radiating, but there are some indications that it may be high. In that case there is an obvious possibility of gradually building somewhat heavier elements out of the lightest ones; this possibility is much improved if *electrons* can also penetrate the nucleus, but the calculation of this case has not yet proved practicable. It seems, however, a plausible assumption. We may then expect that the isotope Be⁸ will be one of the products; this is probably unstable (it does not occur on the earth), and will then almost certainly break up into two helium-nuclei, so that the supply of helium does not become exhausted, and the process