The correction to the spectrum in Fig. 1 due to the above nuclear effect consists in a lateral displacement of the curve by $+\log_{10} n$. As regards the spectrum of all the ionising particles at sea level, which have energies greater than 10^7 volts, a value of $n=5$ requires about 10 per cent of them to have energies greater than 10^{10} volts, and 2 per cent to have energies greater than 10^{11} volts. These estimates assume that the secondary particles have energies between 10^7 and 10^{10} volts.

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* Certain approximations were made in the calculations. The resulting possible errors in the calculated curves, and also the extent to which curve *E* is not an exact representation of the experimental results, are not of a magnitude which affects the present discussion.

¹ *Phys. Rev.*, Jan. 15, 1933.

Absorption Spectrum of the Vitamin E Fraction of Wheat-Germ Oil

So far as we are aware, the only attempt to investigate the absorption spectrum of vitamin E hitherto published is that of Evans and Burr¹, who reported that the vitamin E fraction of wheat-germ oil, while having high general absorption, did not give any definite bands that might help in following the concentration of the vitamin. We have now re-examined this point and have obtained results of a more promising character.

The absorption bands given by the untreated wheat-germ oil were so numerous and diffuse that it was difficult to disentangle them. At the temperature

FIG. 1.

of liquid air, however, the broad diffuse bands became sharper and many of them showed detailed structure, so that the task of analysing and allotting them was rendered very much easier. A description of the bands shown by the non-vitamin fractions will be given elsewhere. The vitamin E fraction, obtained by the saponification of the oil by alcoholic potash at 37°C., followed by extraction with ether and the removal of sterols from the non-saponifiable residue by crystallisation and precipitation by digitonin, gave the curve shown in Fig. 1. The height of the peaks is given only approximately from photometered plates.

The spectrum includes three well-defined bands in the blue with maxima at 4850, 4520 and 4260 Å. These bands, which were remarkably sharp even at ordinary temperatures, were detected in the original

oil, but their strength was increased fifty-fold in the concentrate. In the ultra-violet (apart from a small band at 3370 Å.) stronger absorption began at 3020 Å. with a small step-out at 2860 Å. and a well defined maximum at 2550 Å., followed by general absorption from 2400 Å. down.

The absorption bands were not affected by prolonged exposure of the concentrate to air or oxygen at room temperature, while the only effect of hydrogen peroxide was to increase slightly the absorption in the far ultra-violet at 2400 Å. A stream of 10 per cent ozone, however, passed for a few seconds destroyed both the visible bands and the incipient absorption in the ultra-violet at 3020 Å. and 2860 Å. The band at 2550 Å. was more resistant and was little changed. More prolonged ozonisation caused heavy continuous absorption in the ultra-violet.

The concentrate was not sensitive to light of wavelengths longer than 4000 Å., but exposure to the full light of a mercury arc for a period of 45 minutes destroyed the bands in the visible spectrum as well as the incipient absorption at 3020 Å. and 2860 Å. The band at 2550 Å. was, however, again but little changed.

Experiments on the selective destruction of the various bands by monochromatic irradiation, on the correlation of the strength of bands with biological activity, and on the absorption bands of concentrates of vitamin E from various sources are now in progress.

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¹ Evans and Burr, "Memoirs of the University of California", p. 144, 1927.

Polarisation of Echoes from the Kennelly-Heaviside Layer

THE object of this letter is to correct an error made by me in a letter published in *NATURE* of September 10, 1932, p. 398. The letter dealt with the subject of the polarisation of echoes reflected from the Kennelly-Heaviside layer. It was stated that according to the magneto ionic theory the left-hand circularly polarised ray should be more attenuated than the right-hand one. This is an error and the reverse is the case. I have to thank Prof. Appleton and Mr. Radcliffe for pointing this out in their letter to *NATURE* of September 24, 1932, p. 472.

An accidental reversal of a $\pm$ sign on turning over a page was the cause of the trouble. There is now no disagreement on the theoretical side. As regards the experimental results I find, on looking up my records, that at any rate in one case, the polarisation of the single surviving F_1 echo after the split echo had disappeared was measured in the period immediately following the determination of the polarisation of the components of the split echo, so that the polarisation of the survivor was without doubt the same as the polarisation of the most bent ray in the split doublet, that is, right-handed. This condition persisted, on this occasion, for most of the afternoon.

Recent experience with an improved receiver has substantially confirmed our original observations as to the opposite polarisations of split rays, but indicates that it is impossible to generalise with regard to the strength of the various types of rays.