conditions is proceeding so slowly that individuals of any one species or variety in a taxonomic sense are very nearly identical. On the other hand, the seed yield of many individual plants runs into thousands and millions, which, combined with the losses between pollen production and germination, makes the chances against survival into the second generation of any single pair of gametes enormous. How far natural selection enters into this enormous mortality can never be known : for while accidental mortality deals equally with the less and the more favourable variation, competition verging on mortality puts a high premium on favourable variations, however small, as, for example, in competition for light or plant food.

With regard to the taxonomic characteristics of adult plants, it can for the moment be fairly assumed that they have been attained as a result of intense natural selection extending over millions of years, in which case little difference between individuals is to be expected, and little scope for progressive selection will exist. Whatever differences exist in the relative fitness of adult stages will be reflected in the seed yield, and I have frequently been struck by the wide variations in seed yield between different individuals of *Capsella Bursa-pastoris, Brassica Sinapis, Senecia vulgaris,* and *Bromus mollis.* One individual of these species may easily give rise to a hundred times more seed than another, so that even allowing for accidental differences of soil and situation the scope for natural selection in adult stages is fully comparable with that for seedlings.

The whole subject of seed yield, reproduction rate, and frequency of occurrence in plants needs careful study ; since in all species a very delicate balance exists between rate of reproduction and mortality, and the slightest change in these should lead to striking changes in frequency in species with short life histories ; yet observation shows that this is not the case. Assuming for the moment a habitat occupied by only one species, the number of adult individuals present would probably be very stable for wide differences in seed yield. If, however, *Lolium perenne, Dactylis glomerata, Bellis perennis, Taxacum Dens-leonis, Ranunculus bulbosus,* and *Carduus lanceolatus* are all present in one pasture, why does not one species drive out all the rest, and why is *Lolium perenne* usually more abundant than *Dactylis glomerata,* and *Ranunculus bulbosus* more common than *Taraxacum Dens-leonis* ? In raising these questions, and in remembering rare individuals of still rarer species, one is driven to conclude that suitability to a given habitat plays a predominant rôle in the frequency of occurrence of a given species. One single favourable variation, when fully established, ought to have a marked influence on the frequency of a given species comparable with the results obtained by changing the habitat artificially, as, for example, by liming and draining. From the evidence before us, I must tentatively conclude either that nearly all mortality in plants is not progressively selective, or that progressive variations are occurring at such a rate that they are almost completely eliminated before they became established.

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June 14.

The Heat of Dissociation of Fluorine.

THE heat of dissociation of chlorine, bromine, and iodine has been determined by thermal methods by Bodenstein and estimated respectively to be $+ 56 \cdot 8$, $+ 45 \cdot 2$, $+ 35 \cdot 6$ kilo-cal. No data are yet known regarding the heat of dissociation of fluorine.

I have determined this quantity by reversing the arguments of Franck regarding the absorption spectra of molecules of alkali halogenides. It is well known that the alkali halogenide vapours like NaCl, etc., give a continuous absorption spectrum, the beginning of absorption corresponding to the atomic heat of formation $R = \mathrm{Na} + \mathrm{Cl} - \mathrm{NaCl}$. R is connected with the ordinary heat of reaction $Q . \{Q = [\mathrm{Na}] + \frac{1}{2}\mathrm{Cl}_2 - [\mathrm{NaCl}]\}$ by the relation $R = Q + \frac{1}{2}D_{\mathrm{Cl}_2} + \lambda_{\mathrm{Na}} - \lambda_{\mathrm{NaCl}}$, where D_{Cl_2} is the heat of dissociation of Cl_2 ; λ_{Na} is the heat of vaporisation of Na, λ_{NaCl} is the heat of vaporisation of [NaCl] crystals. It is found that if ν_0 be the frequency of the beginning of absorption, then $h\nu_0$ corresponds almost exactly to the value of R calculated as above in the case of ionic compounds.

I took anhydrous NaF and KF and vaporised them within a silica tube placed within the vacuum graphite furnace of this laboratory, and obtained their absorption spectra. For NaF, the absorption became noticeable at $\lambda2370$; for KF at $\lambda2245$. We can then calculate D_{F_2} from the relation $\frac{1}{2}D_{\mathrm{F}_2} = R - [Q + \lambda_M - \lambda_{MF}]$ in which R is calculated from the absorption spectrum data, the other quantities are taken from Landolt and Bornstein's tables. From NaF data, we get $D_{\mathrm{F}_2} = 78$ kcl., from KF data we get 74 kcl. It appears, therefore, that the heat of dissociation of fluorine is : 76 ± 2 kcl.

I propose to complete the work by performing similar experiments with other alkali fluorides.

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Hyperfine Structure in the Rubidium Spectrum.

IN a preliminary note [1] the lines of the rubidium doublet $1S_{\frac{1}{2}} - 3^2P_{\frac{3}{2}}$ and $1S_{\frac{1}{2}} - 3^2P_{\frac{1}{2}}$ were stated to possess a doublet hyperfine structure with separation of about $0 \cdot 1$ cm.$^{-1}$ and intensity ratio about 2 : 1. These results were obtained with a Fabry-Perot etalon. Meanwhile the lines have been investigated with a reflecting echelon of high resolving power in order to detect the presence of weak lines due to the less plentiful isotope. A third very much weaker component was observed ; the three observed components being at $0 \cdot 00, 0 \cdot 11$, and $0 \cdot 19$ cm.$^{-1}$, with ratios 6 : 3 : 1. This structure is the same for both lines of the doublet.

The two strong lines are evidently due to the more plentiful isotope Rb 85, and the weak line is due to Rb 87. But as the ratio of the sum of the intensities of lines due to Rb 85 to the sum of those due to Rb 87 must be about 4 : 1 (the proportion in which the two isotopes are present), Rb 87 must possess an unresolved component of intensity rather greater than 1. This must be obscured by one or other of the Rb 85 lines. It is more probably the stronger line ($0 \cdot 00$), as this line appears broadened and somewhat asymmetrical.

On this view, Rb 85 possesses a doublet hyperfine structure with separation of $0 \cdot 11$ cm.$^{-1}$ and intensity ratio slightly less than 6 : 3 ; the probable value of i, the nuclear spin, being $3/2$. Rb 87 also possesses a doublet structure, with separation nearly twice as great, and intensity ratio probably smaller.

It is interesting to note that the lines of the heavier isotope are displaced to the violet. A complete account of this work, with photographs of the fine structure, will appear elsewhere.

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[1] D. A. Jackson, NATURE, vol. 127, p. 924 ; 1931.