before or immediately after exposure. The changes responsible for the fall in susceptibility are readily reversed on returning the plants to air, and four hours after exposure to carbon dioxide the treated plants are again as susceptible as untreated controls. Also, plants inoculated for four hours before exposure to carbon dioxide produce as many lesions as control plants.

The effect is unlikely to be a direct inactivation of the viruses, for they are unaffected by long exposure to saturated solutions of carbon dioxide. As exposure is ineffectual four hours after inoculation, it seems that within this time the virus is normally established in tissues where it multiplies, and that some changes in the metabolism of the cell prevent this establishment in the treated plants. Longer exposures than two hours could not be tried as they damaged the plants: even exposure for two hours causes obvious damage unless exposure is made below 10° C. We were, therefore, unable to see if carbon dioxide reversibly inhibits the multiplication of these viruses after they are established, as Woods[1,2] claims that treating plants with potassium cyanide reversibly inhibits the multiplication of tobacco mosaic and tobacco ringspot viruses. Woods attributes this effect to a reversible change in the respiratory system; as carbon dioxide can also reversibly affect respiratory systems of plants, the two phenomena may be related.

H. KALMUS.

Department of Biometry,
University College,
London.

B. KASSANIS.

Rothamsted Experimental Station,
Harpenden, Herts.
Sept. 28.

[1] Woods, M. W., *Science*, **91**, 295 (1940).
[2] Woods, M. W., *Phytopath.*, **33**, 77 (1943).

Alternaria Solani on Tomato

THIS fungus, causing the well-known 'early blight' of potatoes and tomatoes in some countries, has not hitherto been found attacking tomato plants in Britain. There are, however, a few early records, none relating to serious outbreaks, which unfortunately were accompanied by incomplete and inadequate descriptions or by none at all and which, in the light of more recent knowledge of the species, are open to doubt.

In September 1944, in outdoor plantations in Kent and Sussex, this disease was found causing severe leaf and stem spotting to such a degree that, in one instance, a plantation of 1¼ acres assumed a withered or 'scorched' appearance. Lesions occurred at the calyx end of the fruits, which started to rot and fall to the ground.

The fungus associated with the disease may be referred to *Alternaria Solani*, and all the symptoms induced on tomato agree fully with those described in other countries.

It has been thought advisable to make this preliminary announcement before the tomato crop of the 1944 season in Britain has been finally dealt with. A paper describing the occurrence in detail has been prepared for publication.

H. H. GLASSCOCK.
W. M. WARE.

South-Eastern Agricultural College,
Wye, Kent.
Oct. 9.

Electron Mobility in Large Molecules

IN an earlier paper[1], I discussed the longitudinal and transverse polarizabilities of a number of bonds, as calculated from data on refractivity, Kerr constant and depolarization factor. The C–C single bond was exceptional in having a very high ratio (*c.* 100 : 1) of the longitudinal to the transverse polarizability. This indicates that in this bond the electrons can be displaced much more readily in a direction parallel to the bond than in a direction at right angles. It was suggested that this factor might be of importance in connexion with the structure of long-chain compounds.

It appears now that a number of measurable physical properties—polarizability, charge transfer spectra, colour, fluorescence, electrical conductivity and the Van der Waals' forces—are all closely related and may be of great significance with regard to the chemical and biological properties of large organic molecules.

In a series of papers[2], Mulliken has discussed charge transfer spectra and the effects of hyperconjugation. As the name implies, the charge transfer spectrum arises from transitions from an excited state which has an ionic wave function corresponding to the displacement of electrons within the molecule. The more highly conjugated and the more elongated is the structure, the nearer are the normal and the excited states, and the further the spectrum is pushed towards the visible. There is a corresponding enhancement of refractivity and, if the transitions in question are sufficiently intense, colour may also arise. These properties are particularly well exemplified among the polyenes, and Mulliken has suggested that they are related to the tendency of these molecules to polymerize. In β-carotene, his calculations indicate that an electronic charge oscillates over about 32 per cent of the length of the system of eleven conjugated double bonds.

In his theory of the dispersion forces, London[3] has shown the connexion between polarizability and the Van der Waals' forces. In a later paper[4], he has used my anisotropic bond polarizabilities and has also considered the forces between large molecules containing extended electronic oscillators. These forces ('monopole forces') are highly specific and no longer additive. Their range extends far beyond that of the ordinary Van der Waals' forces of small molecules, and this may be of significance in connexion with rubber-like elasticity and the aggregation of polymeric molecules into fibres. The forces are particularly strong in the case of conjugated systems, where the electronic oscillators are of considerable length and of relatively low frequency. Moreover, with regard to electrical conductivity, such a system ". . . forms something like a miniature piece of metal . . .".

The connexion between polarizability and electrical conductivity had also been noticed by Herzfeld[5]. Among the elements, electrical conductivity is attained when the polarizability, as measured by the refractive index, reaches a critical value equal to the cube of the atomic radius. Weiss[6] has discussed fluorescence and the approach to metallic properties among highly conjugated and carcinogenic hydrocarbons. In graphite, the conjugation reaches a very high level: there is appreciable conductivity, and metal-like salts can be obtained. In these, the anions