whereas u.v.-light or mustards cause additional damage to functional proteins to the extent that renewal is necessary prior to continued DNA synthesis.

Although BrUDR is known to produce a primary effect on DNA, there is a continued synthesis of DNA in BrUDR-treated *E. coli* which serves no apparent purpose for survival or cell division. This useless DNA synthesis without concomitant cell division suggests that the inability of *E. coli* to survive in growth medium after exposure to high concentrations of BrUDR is due primarily to loss of DNA function rather than failure to produce DNA.

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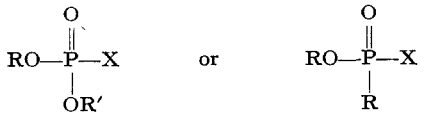
Electronic structure and activity of organophosphorus inhibitors of esterases

The group of substances known as the "nerve gases" and which may be represented by the general formulas



where X is –F, –CN or $-O.C_6H_4 \cdot NO_2$ and R and R′ are alkyl groups (and where the O's may sometimes be replaced by N or S) are highly specific inhibitors of enzymes which possess esterase activity, particularly cholinesterase and acetylcholinesterase[1]. Their mode of action bears striking similarity to the first stage of the process of enzymic hydrolysis of the biochemical substrates themselves: the substituted

phosphoryl group of the inhibitors is transferred to the enzyme with the resultant formation of a phosphorylated enzyme (analogous to the acylated enzymes formed in the reactions with biochemical substrates). The inhibition of the enzyme is due to the stability of its phosphorylated derivative, the active center being thus practically permanently blocked (for possible reasons of this stability, see ref. 2).

The similarity of behaviour of the organophosphorus inhibitors and the biochemical substrates in the first stage of their interaction with the esterases suggests the existence of important structural analogies between these two types of compounds.

Now, it has been shown by PULLMAN AND PULLMAN[3] that practically all the fundamental biochemical substrates undergoing enzymic hydrolysis have the common feature of undergoing this reaction on a π-electron-deficient bond. In related series of substrates the ease of enzymic hydrolysis seems to be the greater the greater the electron deficiency of the susceptible bond.

Calculations carried out for representative organophosphorus inhibitors show that the hydrolysable bond of these compounds has the same π-electron-deficient character as the analogous bonds of the natural substrates (Fig. 1). This situation accounts largely for the observed similarity in the first stage of the interaction of these two types of compounds with the enzymes.

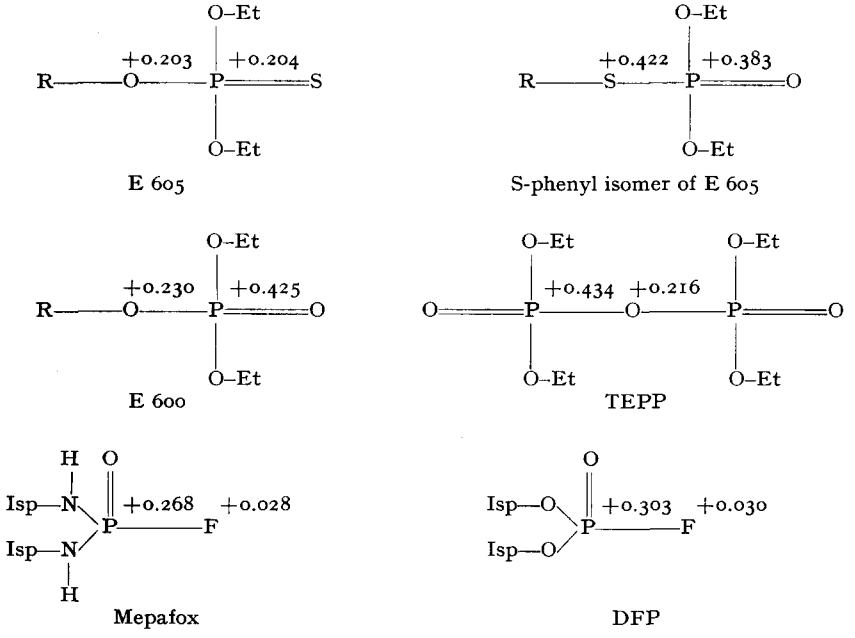


Fig. 1. Formal positive charges on the hydrolysable bond of the organophosphorus inhibitors of esterases (Et = ethyl, Isp = isopropyl, R = *p*-nitrophenyl).

Moreover, it may be remarked that the inhibitory power of related organophosphorus derivatives seems to parallel the value of the positive charge on the P atom. Thus, following ALDRIDGE[4,5] the inhibitory power increases in the series E 605, S-phenyl isomer of E 605, E 600 or when passing from mepafox to DFP. This result may probably be considered as indicating that when other conditions, especially

the steric ones, are similar the inhibitory power depends essentially on the affinity of the P atom for an electron-rich center of the enzyme.

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Interaction between perfluoro-octanoic acid and the fibrous proteins keratin and collagen

KLEVENS and others[1–3] have examined the interaction of perfluoro-octanoic acid ($C_7F_{15}COOH$) with bovine serum albumin. They claim that the F–C–F groups in the PFO replace some water at hydration sites in the protein structure and enter the hydrogen-bond network. Further it is claimed that these F–C–F groups can act as bridges between protein chains. The interaction of PFO with keratin and collagen fibres has now been examined by the authors.

Wool fibres (Corriedale) were placed in a saturated aqueous solution (about 0.023 *M*) of PFO at room temperature (20°). These fibres were examined at regular intervals of time for length and birefringence. After 30 days the fibres appeared to reach a stable contraction of about 4 %. At this stage load-extension curves of the fibres showed a complete disappearance of the initial high-modulus Hookean region of the normal load-extension curve of an undamaged wool fibre in water. The fibres acted mechanically in a very similar manner to a supercontracted fibre in conc. LiBr. The X-ray diffraction pattern of the wool fibres at this stage showed a disappearance of the 5.1 Å meridional arc and a weakening of the 9.8 Å equatorial reflection with an increase in the amount of "arcing" compared with the X-ray diffraction picture of an undamaged fibre. Continuous washing in distilled water over periods up to 7 days gave no noticeable reversal of either the mechanical properties or the X-ray diffraction pattern. It appears that the PFO has penetrated both the matrix and microfibrillar structure of the wool fibre. Extensive washing in water is not able to remove it from the portion of the wool structure responsible for the X-ray diffraction pattern and the mechanical properties when wet, namely the microfibrils[4]. The PFO has disorganized the α-helices probably by taking part in the inter- and intra-chain hydrogen bonding. The inter-helical distance appears to be preserved although there is some disorganization indicated by the change in the 9.8 Å equatorial reflection.

Wool fibres placed in a PFO solution in D_2O at room temperature for 30 days and subsequently washed in D_2O showed a complete hydrogen to deuterium exchange of the hydrogen in the amide –NH (detection technique described by FRASER AND

Abbreviation: PFO, perfluoro-octanoic acid.