approximately corresponded to that of 0·2 ± 0·06 m*M* EDTA in good agreement with the results expected. The super-precipitation of extracted actomyosin was also inhibited by the resin suspension; the activity of the latter was shown to be about one-sixtieth that of EDTA. The size of the resin particle did not significantly influence its relaxing activity in the range of diameter 1–50μ. No relaxing activity of the resin was lost by repeated washings and no soluble substance capable of relaxing came out of the resin, indicating that the resin particle itself was the effective substance.

As has already been noted[1–3], the calcium-binding activity of the physiological relaxing factor is not less than that of EDTA, but exceeds the latter under physiological conditions. It is shown in this communication that a much larger particle than the relaxing factor has a relaxing activity to the extent expected from its calcium-binding capacity. Now it is very probable that the relaxing factor produces the relaxation of the actomyosin systems by a common mechanism with EDTA.

This work was supported in part by grants from the Rockefeller Foundation, *RF*–60141, and the National Institutes of Health, *A*–4810 *B.B.C.*

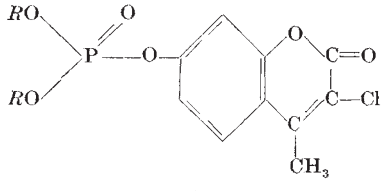
F. Ebashi
S. Ebashi

Department of Pharmacology,
Faculty of Medicine,
University of Tokyo,
Bunkyo-ku, Tokyo.

[1] Ebashi, S., *J. Biochem.*, **48**, 150 (1960).
[2] Ebashi, S., *J. Biochem.*, **50**, 236 (1961).
[3] Ebashi, S., *Prog. Theor. Phys.*, Supp. No. 17, 35 (1961).
[4] Ebashi, F., *J. Biochem.*, **50**, 77 (1961).
[5] Kumagai, H., Ebashi, S., and Takeda, F., *Nature*, **172**, 84 (1955).
[6] Bozler, E., *J. Gen. Physiol.*, **38**, 149 (1954).
[7] Watanabe, S., *Arch. Biochem. Biophys.*, **54**, 559 (1955).
[8] Ebashi, S., Ebashi, F., and Fujie, Y., *J. Biochem.*, **47**, 54 (1959).

A New Class of Compounds showing Anthelmintic Properties

We wish to report anthelmintic activity of a novel class of chemical compounds (patent pending) for which compound I, ($R = ClC_2H_4$–), will serve as an example. This compound, bearing our code number 96*H*60, is *O*, *O* di-(2-chlorethyl) *O*-(3-chloro-4-methylcoumarin-7-yl) phosphate, for which the common name 'Haloxon' is suggested.



I

Oral doses of 'Haloxon' given to sheep and cattle have a very high efficiency against adult worms of the genera *Haemonchus*, *Ostertagia*, *Trichostrongylus*, *Cooperia* and *Strongyloides* and a high level of efficiency against *Nematodirus* and *Bunostomum*. Immature stages of some of these parasites are destroyed. The recommended dose for sheep and cattle is in the range 35–50 mgm./kgm.; but much lower doses are effective against *Haemonchus* spp. and *Cooperia* spp. 'Haloxon' has a marked anthelmintic effect against *Capillaria obsignata* in poultry, oxyurids, *Nematospiroides dubius* and *Strongyloides ratti* in rodents and against ancylostomes and ascarids in carnivores.

'Haloxon' is much less toxic than the related compound 'Coroxon', (I, $R = C_2H_5$–), the substitution of a chlorine atom in the ethyl groups of 'Coroxon' having a very profound effect on anticholinesterase activity. 'Coroxon' in glycerol formal shows an acute oral LD_{50} to rats of 12 mgm./kgm., but for 'Haloxon' in a similar formulation the figure is increased to 900 mgm./kgm. Lambs and yearling sheep have tolerated four to six times the anthelmintic dose. Others have received twenty consecutive weekly doses of 100 mgm./kgm. of 'Haloxon' and have shown no ill-effects. A single oral dose of 250 mgm./kgm. 'Haloxon' to sheep results in a slight depression of red cell cholinesterase activity (which returns to normal within one week of dosing), whereas an oral dose of 10 mgm./kgm. 'Coroxon' results in a 95 per cent depression in red cell cholinesterase activity.

N. C. Brown
D. T. Hollinshead
P. A. Kingsbury
J. C. Malone

Cooper Technical Bureau,
Berkhamsted,
Hertfordshire.

Changes in Absorption during Photosynthesis in the Ultra-violet Spectrum

Seven different types of changes in absorption between 400 and 800 mμ and with lifetimes between 10^{-5} and 10^{-2} sec. have been found in connexion with photosynthesis of green plants. These changes are caused by the formation of the π-π*— triplet states of chlorophyll a_0, resp. b_0 (ref. 1), by probably metastable states of chlorophyll a_1 (ref. 2), by the photo-oxidation of chlorophyll *a* (refs. 3 and 4), by the oxidation of cytochrome[4,5] and by the reduction of added Hill reagents[6]. Changes in absorption at 475 and 515 mμ[7,8] are caused by the reduction of a substance *X* (ref. 6). Changes at 420 mμ are caused by the reaction of an unknown compound. The relations between chlorophyll *a*, cytochrome, *X* and Hill reagents lead to a reaction pattern of photosynthesis as presented in refs. 4 and 5. This report presents evidence for an eighth type of change in absorption.

Bishop[9] has shown that plastoquinone is somewhere involved in transport of electrons during photosynthesis because after extraction of plastoquinone the

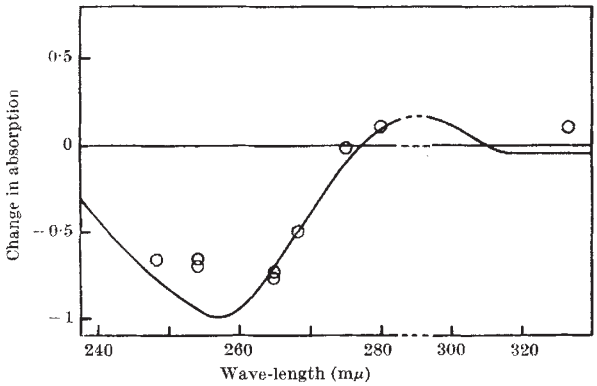


Fig. 1. Change in absorption caused by red illumination of chloroplasts of spinach