A further account of the procedure of analysis pertaining to a viscosimetric rapid method will be published in the *Acta pharmacol. et toxicol.* (Copenhagen).

Since devising this method, we have been able to examine a sample of hyaluronidase from the Treemond Company, Brooklyn, N.Y. This sample was declared to contain 100 turbidity-reducing units per mgm.; by our method this was found to be equal to 2 hyaluronidase units as defined above. We therefore expect the ratio of the turbidity-reducing unit to our hyaluronidase unit to be approximately 50.

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Indicator Yellow and Retinene$_1$

In their interesting article on the "Chemistry of Visual Processes", Ball, Collins, Morton and Stubbs[1] consider that Lythgoe's indicator yellow[2] is a "fortuitous artefact having no direct relevance to visual chemistry". They base this conclusion on the fact that retinene$_1$ may be extracted from bleached retinæ or from bleached visual purple (rhodopsin) solutions by a mixture of acetone, ethanol and light petroleum ether and that "free or loosely bound retinene$_1$ (the final product of bleaching rhodopsin) may combine with any suitable protein or amino-acid which may be available". They regard this fortuitous combination as the means of production of indicator yellow in solution.

These facts do not, however, justify their conclusion. Lythgoe[2] was unable to extract retinene from bleached visual purple solutions using petroleum ether alone as solvent. Hecht[3] has pointed out that alcohol must be added to the petroleum ether in order to extract the retinene. Again, if cold acetone is added to a bleached visual purple solution, the precipitate "contains not only the protein but most of the yellow colour. The retinene must therefore still be mainly attached to the protein, since carotenoids are not easily adsorbed in the presence of high concentrations of acetone" (Hecht, *ibid.*).

The inference is plainly that, after bleaching, the altered visual purple chromophores are still attached to the parent protein (this arrangement constituting the indicator yellow molecule), unless an active reagent such as alcohol strips these altered chromophores (retinene) from the protein. Thus by using alcohol, or other active agent, in the solvent, one is extracting a substance retinene, which is *not*, in fact, "the final product of bleaching rhodopsin". The recombination of retinene with a suitable protein (perhaps, indeed, the original protein from which it was detached) to yield 'indicator yellow' could then scarcely be described as 'fortuitous' but rather the restitution of the original state of affairs.

The visual purple molecule consists of a protein 'base' to which are attached about ten chromophores[4]. It is known that when one quantum of light is absorbed one chromophore is altered[5], but there is no evidence for the statement, often occurring in the literature, that the secondary process following activation of the chromophore is a loosening, that is, a dissociation of the chromophore-protein bond. It is just as probable that activation of a visual purple chromophore by a light quantum is succeeded by a chemical process resulting in an electron transfer down the conjugated carotenoid chain to the protein base and thence, *in vivo*, to the retinal end-organ to which, in all probability, the visual purple molecules are attached. This gives us a simpler picture of the genesis of the physiological impulse than does the usual view that the retinal end-organs are stimulated by a product of the disrupted visual purple molecule.

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[1] Ball, S., Collins, F. D., Morton, R. A., and Stubbs, A. L., *Nature* **161**, 424 (1948).
[2] Lythgoe, R. J., *J. Physiol.*, **89**, 331 (1937).
[3] Hecht, S., "Annual Review of Biochemistry", **11**, 465 (1942).
[4] Broda, E. E., Goodeve, C. F., and Lythgoe, R. J., *J. Physiol.*, **98**, 397 (1940).
[5] Dartnall, H. J. A., Goodeve, C. F., and Lythgoe, R. J., *Proc. Roy. Soc.*, A, **156**, 158 (1936); A, **164**, 216 (1938).

The facts quoted by Dr. Dartnall do not invalidate our conclusions. If under the action of light the retinene is split off, the conditions are such that it is available for recombination with any protein to form new compounds. The spectroscopic evidence indicates that there are three materials in bleached rhodopsin solutions, retinene (or retinene + protein) and the acid and alkaline forms of indicator yellow. We consider that, although the same protein is concerned in all three compounds, yet the chemical evidence indicates that in indicator yellow, retinene is firmly bound while in neutral bleached rhodopsin solutions it is only weakly bound. We agree with Dr. Dartnall's final paragraph.

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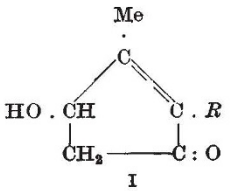
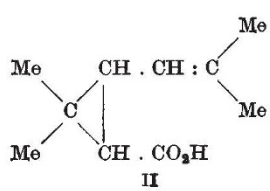
Total Synthesis of some Pyrethrins

In view of recent publications in the United States, it is desirable to record briefly some of the results obtained by us during the past year or so. Following the demonstration by LaForge and Barthel[1] of the heterogeneity of 'pyrethrolone', the alcoholic component of the pyrethrins, and the revision by LaForge and Soloway[2] of the structures of the constituent alcohols to (I), where *R* is butenyl or pentadienyl, and the synthesis by Campbell and Harper[3] of (−)-*trans*-chrysanthemum monocarboxylic acid (II), the enantiomorph of the acidic component of pyrethrin I, the total synthesis of various pyrethrins (that is, esters of I with II), the insecticidal constituents of pyrethrum flowers, appeared a more favourable project than previously.



I



II