soils frequently subject to waterlogging, rather than in well-aerated agricultural soils such as, for example, in most of the wheat-producing areas of Australia.

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A Quantum Yield for the Inactivation of Tobacco Mosaic Virus Protein

THE properties of crystalline tobacco mosaic virus protein serve to make it a most interesting substance for photochemical investigation. Its photo-inactivation by ultra-violet radiation has been demonstrated by several workers[1,2], who have reported a monomolecular reaction for the process, thus indicating that the absorption of a single quantum is sufficient to bring about inactivation of this gigantic molecule. However, the quantum yield of this reaction has never been determined, although it is now possible to do so from existing data by assembling the necessary information from several sources. This calculation will now be made.

The essential inactivation data are contained in a paper of Price and Gowen[1], who exposed a solution of crystalline virus protein having 9·65 mgm. of protein nitrogen per 40 cm.^{3}, in a layer 0·052 cm. thick, to the total radiation output of a 110-volt mercury arc. They found that an average incident dose of 48,900 ergs/mm.^{2} inactivated 50 per cent of the solution, as shown by inoculation tests on young bean plants. Using Stanley's[3] value of 16·4 per cent for the nitrogen content of the virus protein, the concentration of the original solution is calculated to be $8{\cdot}65 \times 10^{-8}$ mols/litre. The number of molecules inactivated per cm.^{3} is then found to be $2{\cdot}62 \times 10^{13}$.

The absorption spectrum of the crystalline virus protein has been measured by Lavin and Stanley[4], who found it to have a maximum molecular extinction coefficient of 8×10^7 at 2650 A. on the basis of a molecular weight of 17,000,000. This absorption curve paralleled approximately the spectral inactivation curve of Hollænder and Duggar[2], indicating that the quantum yield is independent of wave-length and that only wave-lengths less than 3000 A. are appreciably effective. From unpublished data of B. T. Barnes of the General Electric Development Company on the type of mercury arc used by Price and Gowen, it is computed that the emission of radiation in the effective wave-length region comprised only 20 per cent of the total output of the source.

The incident radiation in the effective wave-length range for 50 per cent inactivation of the virus is found to be 978,000 ergs/cm.^{2}, of which 54 per cent is absorbed in a layer 0·052 cm. thick. The fraction absorbed is calculated on the basis of an average molecular extinction coefficient of $7{\cdot}5 \times 10^7$ and a concentration of $8{\cdot}65 \times 10^{-7}$ *M*. Inasmuch as the original concentration of the active virus protein decreased by 50 per cent during the irradiation, the averaged value for the energy absorbed by the *active* molecules is only 72 per cent of the total energy absorbed by the solution, or $7{\cdot}3 \times 10^6$ ergs/cm.^{3}. At λ2650 A., the corresponding number of potentially effective quanta absorbed per cm.^{3} is $98{\cdot}7 \times 10^{16}$. Since the number of molecules inactivated per cm.^{3} was found to be $2{\cdot}62 \times 10^{13}$, the quantum yield turns out as 0·000026.

In other words, only one absorbed quantum out of nearly 40,000 is actually effective in inactivating a virus protein molecule. Although it is realized that this value is the result of several approximations, yet it is probably of the correct order of magnitude. Its meaning is not entirely clear, however, owing to the uncertainty in the molecular weight. For example, if the molecular weight of the active virus molecule were only a tenth as great, then its quantum yield would be ten times as high as that just calculated. In any event, the yield appears to be a very low one.

Quantum yields for the denaturation or inactivation of high molecular weight proteins are known for only a few cases. A recent determination by Landen[5] gave yields varying from 0·0009 at λ2537 A. to 0·009 at λ1849 A. for the inactivation of crystalline urease (mol. wt. 483,000). The inactivation of pepsin (mol. wt. 36,000) by Gates[6] led to a maximum of 0·0014 for the quantum yield at λ2357 A. (as calculated by Landen[5]) with much lower values for longer wave-lengths. Thus the yield value for the virus protein is seen to be smaller and, compared to urease, inversely proportional to the molecular weight.

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Physiological Condition of Anthocyanins in Etiolated Seedlings

SECONDARY products of plant metabolism, such as alkaloids, essential oils, anthocyanins, etc., have been generally looked upon as being definitely eliminated from any further metabolic processes in the plant. Investigations that are now being made with the view of ascertaining the genesis of anthocyanins have led to results that prove the contrary. If, for example, seeds of red radishes (*Raphanus sativus*), or red cabbage (*Brassica oleracea capitata rubra*), are left to germinate on sand, anthocyanins will show as early as the first few days following germination, at first in the cotyledons, and later on in the hypocotyls. Now, if those seedlings are subjected to etiolation, their anthocyanins, affected by the metabolic process of etiolation, will disappear. This will be seen with both cool (50° F.) and warm (95° F.) temperatures. The resorption of anthocyanins will take a few days only, at 95° F., whereas at 50° F. the resorption takes several weeks to be completed.

Essential oils of seedlings of *Salvia officinalis*[1] show a physiological condition that is similar: they are resorbed, as well, by the plant the metabolism of which is affected by etiolation. Alkaloids, too, are apt