

where there is no need to take  $\bar{n}_t^2$  for  $\bar{n}_l$ , because the essential character of WEBER's formula exists in the linear dependence of the inverse of fluorescence polarization on the concentration. The obtained value of transfer frequency agrees with the above-calculated value in the order.

The extent of the migration of a localized exciton during its actual lifetime in the photosynthetic system amounts to  $200 \sim 400 \text{ \AA}$  which is calculated from the diffusion length of Eq. (6), and is smaller than the average diameter of a granum by about  $10^{-1}$  times. This value of the extent of energy migration is comparable with the experimental value  $10^2 \text{ \AA}$  which was obtained by THOMAS, BLAAUW, and DUYSSENS<sup>12</sup> from the relationship between the size and the photochemical reactivity for Hill reaction of fragments of spinach grana.

It may be said that the diffusion model of the localized exciton will be a powerful approach to the problem of the migration of excitation in an aperiodic molecular assemblage like the grana in the photosynthetic apparatus.

**Zusammenfassung.** Das Problem der Energieübertragung im photosynthetischen Apparat wird mit Hilfe des Diffusionsmodells von lokalisiertem Exciton untersucht.

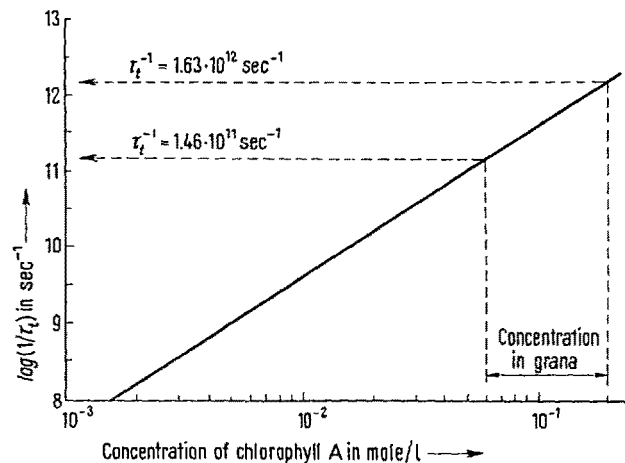


Fig. 1. The relationship between the logarithm of the transfer frequency ( $1/\tau_t$ ) of localized exciton and the concentration of chlorophyll A, where the allowed region of the transfer frequency must be restricted by the inequalities  $10^{13} \text{ sec}^{-1} > 1/\tau_t > 10^8 \text{ sec}^{-1}$ , according to the physical meaning of the localized exciton in an aperiodic molecular assemblage.

## PRO EXPERIMENTIS

### The Recovery of Electron Microscope Grids

Several attempts have been undertaken in this laboratory to clean used copper electron microscope grids, the purchase of which considerably charges the budget. Boiling with detergents was ineffective, as well as the treatment with solvents because of the insolubility of electron bombarded sections and supporting membranes as well as of the carbon coatings.

The following procedure has been found effective and gives a reliable high yield of re-usable grids: the grids are placed on a piece of bronze mesh (about  $2 \times 4 \text{ cm}$  mesh) and drawn through the upper third of a bunsen gas flame. The speed at which the bronze grid is drawn through the flame (about  $10 \text{ cm/sec}$ ) is regulated so that the grids

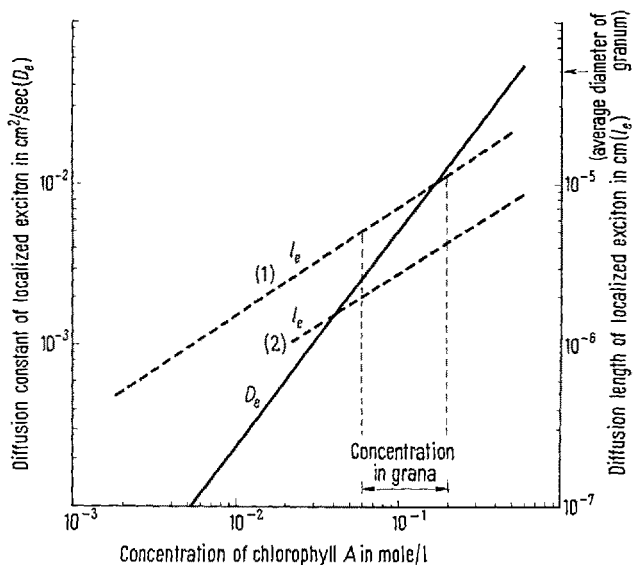


Fig. 2. The dependencies of the diffusion constant ( $D_e$ ) and the diffusion length ( $l_e$ ) of localized exciton in the chlorophyll A molecular assemblage on the concentration of chlorophyll A. (1):  $l_e$  during the optical lifetime  $\tau_0 = 1 \cdot 10^{-8} \text{ sec}$ . (2):  $l_e$  during the actual lifetime of fluorescence of chlorophyll A,  $\tau_{fl} = 1.5 \cdot 10^{-9} \text{ sec}$ , in the photosynthetic system.

Die Schwingungszahl der zwischenmolekularen Energieübertragung, der Diffusionskoeffizient und die Diffusionslänge des Excitons werden mit dem Parameter der Konzentration von Chlorophyll A gerechnet (Figur 1 und 2). Die gewonnenen Resultate ermöglichen den Vergleich mit experimentellen Daten.

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<sup>12</sup> J. B. THOMAS, O. H. BLAAUW, and L. N. M. DUYSSENS, *Biochim. biophys. Acta* **10**, 230 (1953).

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barely glow. After passage through the flame, the grids take on a blue-black colour. Immediately thereafter, the bronze mesh containing the grids is immersed in a nearby dish containing methyl- or ethyl alcohol. The oxide coating of the hot grids is immediately reduced, while the old membranes and the sections have been flamed off. It should be stressed that the flamed mesh should not be allowed to cool before immersion in the alcohol.

**Zusammenfassung.** Es wird ein einfaches Verfahren zur Reinigung elektronenmikroskopischer Trägernetzchen aus Kupfer beschrieben: Abflammen der Netzchen und nachfolgende Reduktion der gebildeten Oxydschicht durch Alkohol.

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