motor impairment produced by the interaction of the two FS's and ECS. Of course this motor effect would have to be specific to a 27.5-second FS-FS interval and to a 0.5-second FS-ECS interval since no increase in latencies is observed with either the 6-hour FS-FS interval or the 30-second FS-ECS interval.

To test for this motor effect, we eliminated conditioning but still maintained the 27.5-second FS-FS pattern. The step-off trial on day 4 was omitted and a fourth sample of 40 additional rats was given two FS's outside the platform apparatus; one group (FS--FS) received no ECS, and a second group (FS--FS,ECS) received ECS 0.5 second after the second FS. Table 4 shows no evidence of conditioning in either group on day 5 and a slight but nonsignificant increase in latencies on day 6. Thus, for step-off latencies to increase significantly from day 5 to day 6, conditioning must occur, and therefore the increase in step-off latencies observed in the 27.5-second FS--FS,ECS group in the first experiment does indeed reflect recovery of a conditioned response.

The experimental results indicate (i) a noncontingent FS given after initial learning suppresses retention when delivered 0.5 second before ECS but does not block retention when delivered 30 seconds before ECS; and (ii) recovery of retention following ECS-produced amnesia varies directly with strength of conditioning.

Previous studies using a single-FS, single-ECS procedure have taken the time-dependent data (that is, amnesia following a 0.5-second FS-ECS interval, retention following a 30-second FS-ECS interval) as evidence for the process of memory consolidation (*4*). Our present findings, however, bring the consolidation notion into question, since they demonstrate that amnesia can be produced 30 seconds or 6 hours after initial learning as long as a noncontingent FS precedes the ECS by 0.5 second. The time-dependent data obtained in the present experiment and those obtained in earlier studies can be accounted for by a single assumption: the 0.5-second FS-ECS interval produces aftereffects that interfere with subsequent retention but the 30-second FS-ECS interval does not produce such aftereffects. On the basis of recent findings in other laboratories (*7*), it may be further speculated that the aftereffects interfere with retention of the avoidance response by reducing "freezing" behavior. Although the aftereffects notion is in need of further tests, the ease with which it accounts for both the time-dependent and recovery data suggests that it is the most parsimonious explanation available.

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Lipids and the Assembly of Chloroplast Membrane

Rosenberg (*1*) postulates that galactosyl diglyceride serves to stabilize the orientation of chlorophyll in the chloroplast membrane. He suggests that this is made possible by a lock-and-key fit between the methyl groups in the phytol portion of the chlorophyll molecule and the methylene-interrupted, *cis* double bonds of the fatty acids in the galactosyl diglycerides. Induced polar interaction of double bonds with methyl groups is proposed as a force that favors binding of the two components. London—Van der Waals forces are also considered by Rosenberg to contribute to this binding. These latter forces alone appear to be powerfully attractive between closely packed molecules in biological systems (*2*). However, the widespread occurrence of methyl groups in proteins and *cis* double bonds in lipids suggests that any unique forces of attraction between such groups and bonds would not only be important in the chlorophyll-galactolipid interaction but of general significance to the formation and function of all lipid-protein complexes.

Another attractive feature of Rosenberg's theory is that it suggests a possible relation between an ordered program of syntheses and an ultimate state of structure and function resulting from the syntheses. Given the high degree of organization existing in the chloroplast membrane (*3*), it seems improbable that such a structure could result by random self-assembly from a mixture of its components (*4*). Rather, when one finds molecules that make an extremely good fit in an organized structure, it is reasonable to assume that one molecule may have served as the template on which an adjoining (bound) molecule was synthesized. In this way each structural-synthetic event determines the next such event and the entire sequence of events determines the functional capability as well as the structure of the whole.

Thus, in the case of Rosenberg's postulation the unsaturated fatty acids of the galactosyl diglycerides may serve as the template for synthesis of the phytol (*5*) which in turn serves as the acceptor for the chlorophyllide. The alternative, that phytol or related isopentyl-containing structures serve as templates for unsaturated fatty acid synthesis, may also deserve consideration.

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References and Notes

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4. The presence of genetic material in the chloroplast [see E. Stutz and H. Noll, *Proc. Nat. Acad. Sci. U.S.* **57**, 774 (1967)] also suggests organized developments of its membranes.
5. According to Rosenberg, other chloroplast compounds composed of isopentyl units, such as the carotenoids and plastoquinones may also be bound by the galactosyl diglycerides in the manner he proposes for phytol.

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