learned prior to or following ECS administration (Misanin & Smith, 1970). These findings suggest that some consideration should be given to the selection of an optimal training-test interval in research on the RA effects of ECS, an interval that would obviate "stimulus change" as a possible factor in altered responsivity (Heistad, 1957).

The present results are also relevant to the recent finding (Kopp, Bohdanecky, & Jarvik, 1968) that repeated ECS treatments prior to training depress the slope of the temporal gradient of RA produced by posttraining ECS. Since the slope of the RA gradient has also been shown to decrease with an increase in ECS intensity (Miller, 1968), it is possible that ECS given repeatedly to animals prior to training reduces their ECT to such a level that their posttraining ECS is equivalent to an ECS of greater intensity given to animals whose ECT has not been altered. That repeated ECS treatments would enhance the depression of ECT found in the present study is suggested by the observation that spontaneous convulsions occur in animals subjected to multiple ECS treatments (Essig, Groce, & Williamson, 1961).

REFERENCES

- CAMPBELL, B. A., & TEGHTSOONIAN, R. Electrical and behavioral effects of different types of shock stimuli on the rat. *Journal of Comparative & Physiological Psychology*, 1958, 51, 185-192.
- ESSIG, C. F., GROCE, M. E., & WILLIAMSON, E. L. Reversible elevation of electroconvulsive threshold and occurrence of spontaneous convulsions upon repeated electrical stimulation of the cat brain. *Experimental Neurology*, 1961, 4, 37-47.
- GOLUB, L. M., & MORGAN, C. T. Patterns of electrogenic seizures in rats: Their relation to stimulus intensity and to audiogenic seizures. *Journal of Comparative & Physiological Psychology*, 1945, 38, 239-245.
- HEISTAD, G. T. A bio-psychological approach to somatic treatments in psychiatry. *American Journal of Psychiatry*, 1957, 114, 540-545.
- KALINOWSKY, L. B., & KENNEDY, F. Observations in electric shock therapy applied to problems of epilepsy. *Journal of Nervous & Mental Disorders*, 1943, 98, 56-57.
- KOPP, R., BOHDANECKY, Z., & JARVIK, M. E. Proactive effect of a single electroconvulsive shock (ECS) on one-trial learning in mice. *Journal of Comparative & Physiological Psychology*, 1968, 65, 514-517.
- MERITT, H. H., & PUTNAM, T. J. A new series of anticonvulsant drugs tested by experiments on animals. *Archives of Neurology & Psychiatry*, 1938, 39, 1003-1015.
- MILLER, A. J. Variations in retrograde amnesia with parameters of electroconvulsive shock and time of testing. *Journal of Comparative & Physiological Psychology*, 1968, 66, 40-47.
- MISANIN, J. R., & LEWIS, D. F. Sensitivity and reactivity to foot shock following electroconvulsive shock stimulation. *Physiology & Behavior*, 1970, 5, 397-405.

- MISANIN, J. R., & SMITH, N. F. The effect of training on ECS-induced hyperreactivity to footshock. *Psychonomic Science*, 1970, 20, 43-45.
- RUSSELL, R. W., PIERCE, J. F., & TOWNSEND, J. C. Characteristics of tissue impedance in the rat under conditions of electroconvulsive shock stimulation. *American Journal of Physiology*, 1949, 156, 317-421.
- WALTER, W. G., & GOLLA, F. L. Electrically

- induced convulsions. *Lancet*, 1940, 238, 127.
- WOODBURY, D. M. Effect of hormones on brain excitability and electrolytes. *Recent Progress in Hormone Research*, 1954, X, 65-107.
- WOODBURY, L. A., & DAVENPORT, V. D. Design and use of a new electroshock seizure apparatus, and analysis of factors altering seizure threshold and pattern. *Archives Internationales de Pharmacodynamie et de Therapie*, 1952, XCII, 97-107.

Retention of latent inhibition*

SHEPARD SIEGEL

McMaster University, Hamilton, Ontario, Canada

The purpose of the experiment was to determine whether or not latent inhibition (the deleterious effect of preconditioning exposure to the CS on subsequent acquisition) is attenuated by interpolating a delay between the last session of preconditioning exposure to the CS and the first session of acquisition. Independent groups of preexposed Ss were given classical eyelid conditioning either immediately following their 550th CS-alone presentation, or 24 h after their 550th CS-alone presentation. Control groups had no experience with the CS prior to acquisition. Preexposed Ss were slower to acquire the CR than were control Ss, replicating previous reports of latent inhibition in the eyelid conditioning situation. Furthermore, the magnitude of latent inhibition was unaffected by the interpolation of a delay interval between preexposure and acquisition.

A number of classical conditioning studies have demonstrated that, with a variety of species, preacquisition exposure to the CS retards acquisition (see reviews by Cantor, 1969; Siegel, in press). This phenomenon has been termed "latent inhibition" (Lubow & Moore, 1959). In contrast with findings demonstrating latent inhibition, Suboski, DiLollo, & Gormezano (1964) have reported that preexposing rabbits to the CS does not retard subsequent nictitating membrane conditioning. It does not appear likely that this finding was due to the species used, since other investigators have subsequently reported latent inhibition with rabbit Ss (Lubow, Markman, & Allen, 1968; Siegel, 1969a, b, in press). Lubow et al (1968) suggested that one feature of the Suboski et al (1964) investigation that may have accounted for their failure to demonstrate latent inhibition was the interpolation of a 24-h period between the last preexposure session and the first acquisition session. Suboski et al (1964) preexposed Ss to the CS during four daily sessions (70 CS presentations per day), with a 24-h delay between the last preexposure session and

the first acquisition session. It is possible that preexposure effects dissipate over time, and interpolating a 24-h interval between preexposure and acquisition would eliminate the effects of such preexposure on acquisition.

The present experiment was designed to assess the degree to which a 24-h delay between preexposure and acquisition attenuates latent inhibition.

SUBJECTS AND APPARATUS

The Ss were 47 experimentally naive male New Zealand White rabbits, weighing 2-3 kg. Conditioning was carried out in a sound-attenuated chamber, with S placed in a restraining box within the chamber. The outer eyelid response was recorded with a modification of the technique described by Gormezano (1966). Briefly, movement of Ss' left outer eyelid was conducted, via a string and pulley arrangement, to the shaft of a microtorque potentiometer. Voltage changes through this potentiometer were graphically recorded and provided a measure of eyelid activity.

The US consisted of a 100-msec, 200-V ac shock, delivered to a pair of chronically implanted titanium wire electrodes, mounted approximately 1 cm apart and 1 cm below the left eye. The CS was a 500-msec, 2,000-Hz tone at 82 dB above

*This research was supported by Grant APA-0298 from the National Research Council of Canada.

Fig. 1. Mean percent CR over consecutive blocks of 25 acquisition trials.

.0002 dynes/cm². Background white noise was presented throughout the experimental sessions, except for the 500-msec periods of CS presentation.

PROCEDURE

The experimental design was a 2 by 2 factorial, with two levels of delay interpolated between preexposure to the CS and the start of acquisition (0 vs 24 h) combined factorially with two levels of CS preexposure prior to conditioning (0 vs 550 CS presentations). Ss were run during consecutive, daily 100-min sessions. Rabbits preexposed to the CS received 100 CS presentations for 5 days, and 50 such presentations during the first half of the Day 6 session. The interval between successive presentations of the CS was 0.5, 1.0, or 1.5 min (average: 1.0 min). Preexposed Ss who started acquisition immediately upon termination of preexposure (Group P-I) received 50 acquisition trials during the second half of the Day 6 session; the 100-msec US was presented immediately upon termination of the 500-msec CS. Preexposed Ss receiving acquisition training following a 24-h delay interval interpolated between preexposure and acquisition (Group P-D) were simply restrained in the conditioning apparatus for an additional 50 min without any additional CS presentations following the last CS-alone presentation on Day 6. On Day 7, Group P-D Ss received 50 min of restraint in the apparatus prior to receiving 50 acquisition trials. Thus, Ss in Group P-D, like Ss in Group P-I, received 50 acquisition trials on the first day of acquisition, and this training started in the middle of a 100-min daily session.

Control group Ss not preexposed to the CS (Groups C-I and C-D) were treated like

Ss in Groups P-I and P-D, respectively, except that they were simply restrained in the conditioning apparatus and experienced no CS presentations prior to the start of acquisition.

All Ss received Acquisition Trials 51-150 and 151-250 on the 2 days following the first acquisition day.

Twelve Ss were assigned originally to each of the four groups, but one S in Group C-I died during the course of the investigation.

RESULTS

The mean percentage CR for each group over consecutive blocks of 25 acquisition trials is shown in Fig. 1. A mixed design analysis of variance of the data shown in Fig. 1 indicated a significant trial blocks effect ($F = 104$, $df = 9/387$, $p < .001$), reflecting the increase in performance for all groups over the course of acquisition. Examination of Fig. 1 indicates that preexposed Ss (Groups P-I and P-D) were slower to acquire the CR than were groups not receiving experience with the CS prior to acquisition (Groups C-I and C-D). This was confirmed by the results of the analysis of variance, which indicated that the effect of preexposure was significant ($F = 19.0$, $df = 1/43$, $p < .001$). The analysis also revealed significant Preexposure by Trial Blocks interaction ($F = 7.70$, $df = 9/387$, $p < .001$), reflecting the faster rate of acquisition of Ss in the control groups.

As may be seen in Fig. 1, there was no tendency for the interpolation of a delay interval between preexposure and acquisition to attenuate the deleterious effects of preexposure. Indeed, the preexposed group with this interpolated delay (Group P-D) was, if anything, slower

to acquire the CR than the preexposed group receiving acquisition training immediately following preexposure (Group P-I), a similar trend being evidenced in the nonpreexposed control groups. However, the effect of the delay variable did not approach statistical significance, nor were any of the interactions involving the delay variable (Preexposure by Delay, Trial Blocks by Delay, Trial Blocks by Preexposure by Delay) significant (all p values $> .20$).

DISCUSSION

The present investigation demonstrated that preexposure to the CS retards acquisition, confirming previously reported findings of "latent inhibition" in the eyelid conditioning situation with both human (Schnur & Ksir, 1969) and rabbit (Siegel, 1969a, b) Ss. Furthermore, it appears that acquisition need not be initiated immediately upon termination of preexposure in order to demonstrate latent inhibition. In the present investigation, the magnitude of latent inhibition was the same whether or not a 24-h period elapsed between the end of preexposure and the start of acquisition. Thus, the failure of Suboski et al (1964) to obtain retarded acquisition following CS preexposure cannot be attributed simply to the fact that, in their study, a 24-h period was interpolated between preexposure and acquisition.

REFERENCES

- CANTOR, G. N. Stimulus familiarization effect and change effect in children's motor task behavior. *Psychological Bulletin*, 1969, 71, 144-160.
- GORMEZANO, I. Classical conditioning. In J. B. Sidowski (Ed.), *Experimental methods and instrumentation in psychology*. New York: McGraw-Hill, 1966. Pp. 385-420.
- LUBOW, R. E., MARKMAN, R. E., & ALLEN, J. Latent inhibition and classical conditioning of the rabbit pinna response. *Journal of Comparative & Physiological Psychology*, 1968, 66, 688-694.
- LUBOW, R. E., & MOORE, A. U. Latent inhibition: The effect of nonreinforced pre-exposure to the conditioned stimulus. *Journal of Comparative & Physiological Psychology*, 1959, 52, 415-419.
- SCHNUR, P., & KSIR, C. J. Latent inhibition in human eyelid conditioning. *Journal of Experimental Psychology*, 1969, 80, 388-389.
- SIEGEL, S. Effect of CS habituation on eyelid conditioning. *Journal of Comparative & Physiological Psychology*, 1969a, 68, 245-248.
- SIEGEL, S. Generalization of latent inhibition. *Journal of Comparative & Physiological Psychology*, 1969b, 69, 157-159.
- SIEGEL, S. Latent inhibition and eyelid conditioning. In A. H. Black & W. F. Prokasy (Eds.), *Classical conditioning II*. New York: Appleton-Century-Crofts, in press.
- SUBOSKI, M. C., DILOLLO, V., & GORMEZANO, I. Effects of unpaired acquisition exposure of the CS and UCS on classical conditioning of the nictitating membrane response of the albino rabbit. *Psychological Reports*, 1964, 15, 571-576.