ray Hill, N.J.) and by D. H. Kelly (Itek Laboratories, Lexington, Mass.). Both Levinson and Kelly noted, independently, that the fundamental of the stimuli used in the experiment has sufficient amplitude to account for the obtained results. They point out, correctly, that the conditions of the experiment were such that the amplitude was not only constant but, at the fusion point, of a magnitude that is quite in line with previous results, about 0.5 to 3.5 percent.

The formula for computing this amplitude, as provided by Levinson and Kelly, is

$$m_1 = \frac{2}{\pi}\left[\tan\frac{\pi}{4N_s} - \tan\frac{\pi}{4N_v}\right]\bar{l}$$

where N_s and N_v are the number of pulses in the standard and variable trains, respectively, and $\bar{l}$ is the average luminance. This formula is exact for the case of standard and variable pulse trains of equal duration. Where N_s and N_v are large, the usual small-angle approximation for the tangent may be made.

Our assumption, in writing the paper, was that the amplitude of the fundamental would not be constant over the many conditions of the experiment, during which frequency was held nearly constant. Our checks on this point were in error. No "nonlinear property" of the visual system is revealed. On the contrary, the results provide another confirmation of the low-pass filter-like behavior of the eye above 12 cycles per second or so [H. de Lange, *J. Opt. Soc. Am.* **48**, 777 (1958); D. H. Kelly, *ibid.* **51**, 422 (1961)]. This property of the eye diminishes the effectiveness of the higher harmonic components of complex stimulus wave forms relative to the fundamental [J. Levinson, *Science* **130**, 919 (1959); D. M. Forsyth, *J. Opt. Soc. Am.* **50**, 337 (1960)]. The results also confirm the justice of the plea of Kelly [*J. Opt. Soc. Am.* **51**, 917 (1961)] "that experiments with nonsinusoidal periodic stimuli should be designed on the basis of a preliminary harmonic analysis of the waveforms used."

D. M. Forsyth
Department of Psychology, Goucher College, Towson, Maryland
Charles R. Brown
Operational Applications Laboratory, Electronic Systems Division, Hanscom Field, Bedford, Massachusetts

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Simple Method of Harvesting Limnoria from Nature

Abstract. Outward diffusion of salt from a concentrated solution placed in a centrally bored, cylindrical hole causes *Limnoria* to collect at the surface of infested wood.

The small marine isopod, *Limnoria,* can digest cellulose and multiply at the expense of this and other substances contained in pilings, dock supports, ships' hulls, floats, barges, or other wooden structures immersed in seawater. The unusual properties of its digestive system, as well as the worldwide, billion-dollar destruction caused by this organism, has led to considerable biological and biochemical research from both basic and applied points of view (*1*). Such research inevitably involves harvesting a supply of specimens from nature, sometimes at frequent intervals and in exceedingly large numbers, depending on the objective of the work.

A convenient solution to the problem of obtaining living, undamaged specimens from the depths of infested wood has been sought in various ways, such as electric shocks, partial putrefaction of the material, and so forth (*1*), but the end result has generally proved either unsatisfactory or unreliable in comparison with the laborious, time-consuming, and painstaking procedure of gradually shaving down the wood with scalpel or razor and gently removing with a pair of forceps whatever individuals chanced to escape laceration or other damage to their brittle exoskeleton and delicate organs.

We have recently found a simple way to cause virtually the entire population of *Limnoria,* comprising hundreds or thousands of individuals in a heavily infested, small block of wood (Fig. 1) to move out of their burrows and adhere at the surface. It is merely necessary to drill a cylindrical hole of suitable diameter down the center of the wood, fill with an oversaturating suspension of sodium chloride in sea water, and cork up the cylinder. The wood is then left immersed in a shallow pan of sea water. In the course of several days, as the salt diffuses slowly from the center, the *Limnoria* move outward. The method is simple, efficient, and possibly applicable to comparable situations involving other types of microfauna (*2*).

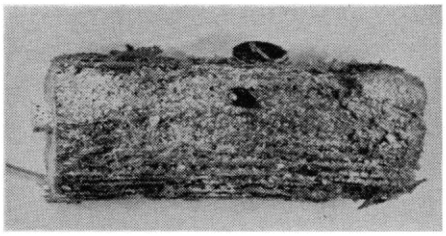

Fig. 1. Active, healthy specimens of *Limnoria* at the surface of a block of wood, 7½ by 3 inches, from a partially destroyed dock. The organisms were driven from their burrows by boring a central hole, ½ inch in diameter, through most of the length of the wood, filling the hole with seawater oversaturated with NaCl, closing with a cork, and leaving the preparation immersed in seawater for several days. [J. Gonor]

Frank H. Johnson*
Dixy Lee Ray
Friday Harbor Laboratory, University of Washington, Seattle

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* Present address: Department of Biology, Princeton University, Princeton, N.J.

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Plasma-Free Corticosteroid Response to Electric Shock in Rats Stimulated in Infancy

Abstract. Circulating corticosteroids were measured after a brief electric shock in rats which were manipulated during infancy. When compared to nonmanipulated controls it was found that the manipulated rats showed a significant elevation of corticosteroids as early as 15 seconds after shock, whereas the nonmanipulated subjects did not show a significant elevation of steroids until 5 minutes after a brief shock. Further, the levels of corticosteroids were consistently higher in the manipulated subjects over a 15-minute period.

Recent experiments which have been reported concerning the effects of infantile experience in the responses to stress in the adult organism have in general indicated that animals which have been treated in a variety of ways as infants tend to exhibit a less pronounced physiological response to stress in adulthood than their nontreated counterparts.

Thus hypertrophy of the adrenal after chronic exposure to such stressors as an injection of hypertonic glucose (*1*) or daily exposure to fear-producing stimuli (*2*) is significantly less in the animal which had been treated in infancy. For the rat, manipulation in infancy increases the length of survival under conditions of prolonged food and water deprivation (*3*). These data have been used to support the hypothesis that infantile stimulation of an animal produces resistance to stress because the animal's physiological response to a challenging stimulus is less vigorous. However, all the data which have been invoked to substantiate this hypothesis have been obtained in experiments which have presented the animal with relatively chronic stress conditions where a vigorous and sustained response to stress can result in many pathological changes and reduced viability.

If infantile stimulation simply makes an animal less responsive to stress, then it would be expected that animals so treated in infancy should be less responsive when confronted with acute noxious stimuli. However, the little evidence available on the differential response to *acute* stress as a function of infantile stimulation does not support the position that animals manipulated in infancy are less responsive to acute stress. In fact, infant rats which had been previously manipulated exhibit a significantly *greater* depletion of adrenal ascorbic acid than do nonmanipulated controls after 90 minutes of exposure to cold (*4*).

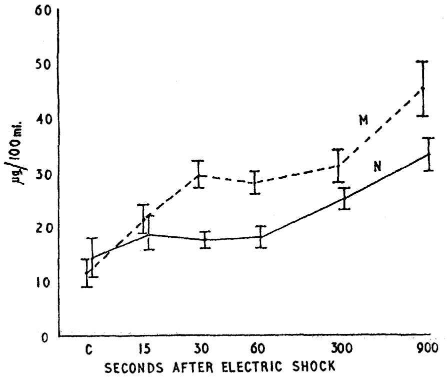

Fig. 1. Plasma-free corticosteroid values over time in manipulated (dashed line) and nonmanipulated (solid line) rats. Each point represents the mean value and the bars represent the standard error.

The present study (*5*) was designed to investigate further the response of manipulated and nonmanipulated rats to an acute noxious stimulus in adulthood. The design of this experiment is similar to that of Fortier *et al.* (*6*). Forty-eight male Sprague-Dawley albino rats bred in the laboratory of the Research Division of the Columbus Psychiatric Institute and Hospital were used as subjects. Half the animals were subjected to the standard manipulation procedure described previously (*1*). At weaning all rats were placed in group cages (six to eight per cage) until about 60 days of age. The animals were then placed in individual cages for 10 days, and each rat was then assigned to one of six groups. Each group consisted of four manipulated and four nonmanipulated rats. Rats in one group were decapitated as rapidly as possible with a Harvard Apparatus guillotine. The five remaining groups were placed in a shock chamber. A shock of 0.8 ma to the feet was delivered for 30 sec, followed by a 30-sec interval; the same shock was delivered for 20 sec, followed by a 20-sec interval; and a shock of 1.0 ma was then delivered for 10 sec. The rats were then removed from the shock chamber and decapitated. Each group was decapitated at a different time after shock. The intervals were 15, 30, 60, 300, and 900 seconds after the last shock. Blood was collected in a heparinized beaker, and the amount of corticosterone present in the blood was estimated by the method of Sibler *et al.* (*7*). The results are presented in Fig. 1. Within 15 seconds after shock the manipulated rats had a significantly elevated level of circulating steroids, whereas a significant rise in steroids could not be detected in the nonmanipulated rats until 300 seconds after shock. Further, within the time limits investigated, the level of circulating steroids remained significantly higher in the manipulated rats. The distributions of concentrations from 30 seconds on show only one overlap between manipulated and nonmanipulated rats. It is difficult to say what the results might be for intervals longer than 900 seconds, but the available evidence leads to the expectation that the steroid level would fall more rapidly for the manipulated rats. A recent report by Bell *et al.* (*8*) tends to support this prediction.

The data clearly reject the notion that infantile manipulation makes an animal less responsive to stress. Both the infant and adult manipulated rats make a more rapid and greater response to distinct and acute stressful conditions, whereas when the conditions of stress are more chronic it is the nonstimulated animal that appears to exhibit the greater and more prolonged response to stress.

It appears that one of the effects of infantile stimulation is to impart to the organism by some as-yet-unspecified mechanism the capacity to respond "more appropriately" to the demands of the environment which include stress. In addition to the results of the present study, it has been reported that situations which do not have intense noxious properties, such as strange environments or merely transporting the animal from one laboratory to another, do not elicit an observable stress response in the animal which has been stimulated in infancy. In contrast, the nonstimulated animals do respond to such situations with a readily observable stress reaction either in terms of increased autonomic reactivity (*9*) or a marked drop in leukocytes (*10*). These results indicate that there is a difference between animals stimulated in infancy and nonstimulated animals in the manner in which they respond to environmental change, although not necessarily in the direction of a diminished stress response.

SEYMOUR LEVINE
Department of Psychiatry, Stanford University, Palo Alto, California

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