jections of the treated bacterial suspensions over a 2-week period showed no evidence of toxicity and responded with the same increase in antibody titer that rabbits treated with formalinized vaccine did.

The presence of protein in the reaction solution reduced the effectiveness of treatment, and increased energy was required for complete sterilization.

The mechanism by which death of the various species occurs is not known but is under investigation. The following facts are pertinent to this investigation. Death does not occur by disruption of the cell wall. Electrohydraulic discharge does result in the formation from the water of very active chemical species, such as free radicals and ions that are short-lived but may be responsible for the effect. The high shock-wave pressure resulting from the discharge may cause these active chemical species to be forced through the cell wall, thus enhancing their effect. The fact that increased energy is required when protein is present suggests that protein in solution may absorb these active radicals and ions and in this manner diminish the effect. Shock-wave pressures do not cause any perceptible damage to the cell wall, but they may cause internal damage, and this may result in death of the bacterial cell.

Electrohydraulic treatment is an extremely effective, essentially instantaneous, and inexpensive way to sterilize water and sewage without a rise in temperature or the addition of chemicals or foreign materials.

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Disinhibition of Visually Masked Stimuli

Abstract. *Backward-masking conditions were established for a pair of circular-patch stimuli. A third stimulus was then selected so as to mask the second when the second and the third were presented in the absence of the first. When all three stimuli were presented in serial order, the first and third were reliably detected but the second was not. Apparently, by masking the second flash, the third "disinhibited" the first.*

Crawford (*1*), in a now classic experiment, demonstrated that subsequent stimulation reduced sensitivity to a preceding flash. He found that when a second "conditioning flash" (CF) of 12° area and 524-msec duration followed a 10-msec, 0.5° "test flash" (TF) by as much as 100 msec, threshold sensitivity to TF was elevated. This phenomenon of backward masking has been reported subsequently by a number of investigators (*2*, *3*) and has been reviewed recently by Raab (*4*). It appears, moreover, to be a general property of sensory information processing, demonstrable in the skin sense (*5*), in audition (*6*), and in color vision (*7*).

Crawford's explanation of backward masking was rooted in "transmission-time" interactions; that is, CF, being greater in area and duration, overtakes TF in the processing through the visual radiations and arrives earlier at the cortical level. More recently observed conditions (*3*) in which the preceding TF must be *more* intense than the following CF, however, require a more dynamic neuroinhibitory mechanism than is implied in transmission effects. The experiment here reported describes a preliminary attempt to suggest such a process. Specifically, it extends classical backward-masking research by incorporating a *third* stimulus, one that follows TF and CF at an interval short enough to mask CF. Under these conditions, it was of interest to determine the resulting effects upon the detection of TF, the first in the train of three flashes.

Two male laboratory assistants, naive with respect to the specific experiment, were used as subjects. Stimuli were presented by means of a Scientific Prototype Three-Channel Tachistoscope. Each channel of this device holds a pair of argon-mercury vapor-discharge lamps. The associated timing circuits permit continuous control of the flash duration of each field and of the interval between successive flashes, from 110 μsec to 110 seconds. Stimulus area is varied by inserting fixed-diameter apertures in the frame-holders of each field, which are positioned anterior to the respective lamp compartments. Although coarse intensity controls are available, nonlinearities require the use of neutral density filters for accurate variation of luminance.

In the present experiment, three aperture diameters were used; field 1 contained a circular aperture of 2 mm; field 2, 4 mm; and field 3, 8 mm. At the viewing end, 18 inches (46 cm) from these apertures, these circular patches subtended 0.23°, 0.46°, and 0.92° of visual angle, respectively. With opal diffusing screens positioned between source and view, the overall configuration provided circular flashes of different areas and homogeneous luminance, the latter maintained at 5.0 mlam, for each field.

After 10 minutes of dark adaptation, subjects were given practice in identifying each area with an appropriate number; 0.23° = 1, 0.46° = 2, and 0.92° = 3. Subjects were told that, on any given trial, any one or combination of areas could be presented simultaneously or successively. Their task, at the end of a presentation, was to report whether 1, 2, or 3 or any combination had been presented. The experiment consisted of 400 trials per subject: 50 at each of four TF-CF intervals (25 msec, 50 msec, 75 msec, and 100 msec) in the absence of a third flash, and 50 trials at each of the same four intervals in the presence

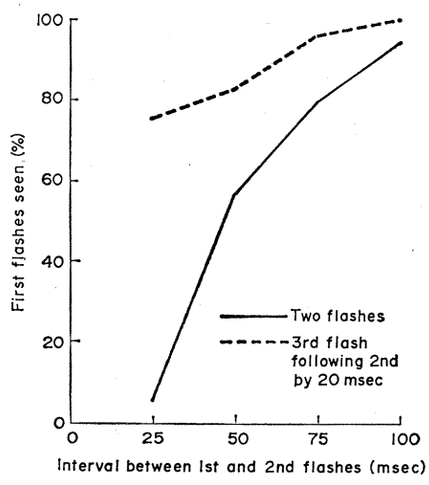

Fig. 1. Pooled data from two subjects showing percentage of first flashes detected as a function of the interval between first and second flashes for two conditions: one in which no third flash followed (solid curve), and one in which a third flash followed the second by 20 msec (dashed curve). Each point is based upon 100 trials.

of a third flash which followed CF by a constant 20 msec. All flashes were of 20-msec duration. A total of 15 "catch" trials were interspersed randomly among each block of 50 trials. Both subjects correctly reported which of the three single "catch" flashes had been presented on every one of these trials. Thus, it could be concluded that (i) variations in adaptation level during a session did not seriously influence flash detectability; (ii) reports on non-catch trials were not the outcome of guessing; and (iii) subjects had learned to identify a particular number with the appropriate stimulus area. On all trials, both the "catch," on which only one of the fields was presented, and the test, on which either two or three were presented, a "ready" was announced before presentation, no fixation patch was employed, and viewing was monocular.

The major results of the experiment are summarized in Fig. 1, which is a plot of the percentage of the trials on which the first flash (TF) was seen as a function of the TF-CF interval. Two functions are shown, one for trials containing two flashes only and one for trials on which the second flash was followed by a third. Since the data from the two subjects were essentially superimposable, they have been pooled. The results indicate marked facilitation of TF detection in the presence of a third flash. At those TF-CF intervals over which CF reliably backward-masks TF when no third flash followed, the detection of TF becomes reliable in the presence of a third flash. Further, CF was not detected on any of the "third flash present" trials. At the shortest TF-CF interval (25 msec), the χ^2 significance of the difference between corresponding points on the two detection functions is beyond $p = 0.01$.

While the present study reports data from only two subjects, the observed *disinhibitory* effect has been confirmed in a dozen others in pilot research incorporating the same features as those described. Because of the temporal range of the effect, cortical mechanisms may be considered. In this connection, I have reported elsewhere (*8*) reliable electroencephalographic correlates of peripheral spatial and temporal summation. Moreover, Donchin *et al.* (*9*) have demonstrated representation of two-flash summation, resolution, and inhibition in human cortical-evoked potentials. These findings, considered in the context of the present data, bring human psychophysical and gross electrophysiological data to bear upon spatiotemporal inhibitory processes so prominent in the *Limulus* visual system (*10*).

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3 August 1966

Grizzly Bear Skull: Site of a Find Near Lake Simcoe

In 1965 Peterson (*1*) reported the find of a skull of a grizzly bear of the *Ursus arctos-horribilis* complex near Lake Simcoe, Ontario, aged 11,700 ± 250 years. "The specimen was discovered in a load of gravel removed from approximately 30 feet [9 m] below the local grade of a commercial gravel pit in November 1964." We visited the site in June 1965 and examined the shorelines associated with the stages of Glacial Lake Algonquin to determine which of the several water planes (*2*) corresponded with the gravel in which the skull was found.

The gravel pit, operated by J. and B. Ennis, is situated on lot 12, concession II, Orillia Township, Simcoe County, just east of provincial highway 11. The deposit is poorly sorted coarse and fine gravel interbedded with sand and silt. The pit is well below a shore bluff that reaches approximately 251 m above sea level and is associated with the Ardtrea Beach as mapped by Deane (*2*)—the first well-pronounced beach below that of the main Algonquin shoreline which is here about 255 m above sea level. Standing at the site of the skull, one can look up to the main Algonquin Beach, which is well developed to the northwest. There is no doubt that the gravel deposit that yielded the skull is lower in elevation than the main Algonquin water plane and the gravels associated with that plane.

The gravel deposit is strongly crossbedded and was built on what may have been an island or a headland in the glacial lake associated with the Ardtrea strand. There is evidence that deposition was extremely rapid, which rapidity would explain the excellent preservation of the skull.

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Random Light and Wheel Running

Holmquest, Retiene, and Lipscomb found (*1*), in testing the effects of a random lighting regime on ten rats, that wheel-running measured as total group activity appeared to become desynchronized. They concluded that this was caused by the development of activity rhythms having periods shorter and longer than 24 hours and that random lighting modifies or nullifies the effect of light on mammalian biological rhythms.

An experiment which I have performed indicates that random light does not disrupt the activity rhythm of hamsters (*Mesocrietus auratus*) to any greater extent than constant light. The activity of five hamsters in individual cages equipped with running wheels was measured. The temperature was 19.5° ± 1°C, and the light intensity was about 11 lu/m². The animals were placed for 9 days on a cycle of 12 hours of light and 12 hours of darkness, and then they were exposed to random light. This differed from the random-light sequence of Holmquest *et al.* in that successive days did not have the same proportion of light and darkness and that the shortest light or dark period was 15 minutes instead of 1 hour. Random light was continued for 15 days, after which the hamsters were exposed to constant light for 17 days.

Under the 12:12 LD cycle all hamsters showed a nocturnal activity pat-