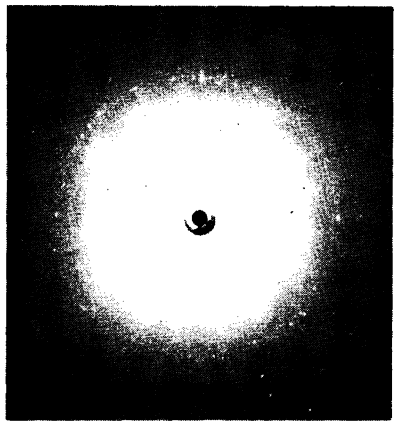

Fig. 2. X-ray diffraction photograph of the epicuticle of *B. tamulus gangeticus*.

It is evident that the epicuticle of the scorpions *P. bengalensis* and *B. tamulus gangeticus* is nonchitinous.

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17 June 1957

Withdrawal of Positive Reinforcement as Punishment

Many experiments have shown that an organism's behavior can be maintained by the use of positive reinforcement (reward). At the same time, the withdrawal of the situation in which the reinforcement occurs has been described as an aversive event (*1*) and is called a "time out." This experiment (*2*) shows some of the aversive properties of a time out from positive reinforcement in chimpanzees. The procedure here is very similar to one used by Azrin in which electric shock is the aversive event and pigeons are the subjects (*3*). In such cases, light or sound (pre-aversive stimulus) preceding the aversive event disrupts the animals' usual performance.

In this experiment the aversive event (time out from positive reinforcement) was established as follows. The chimpanzees pressed a telephone key, which occasionally produced food. An overhead light in the experimental chamber was periodically turned off, and at the same time the food magazine was disconnected from the key. The animals soon stopped pressing the key in the absence of the overhead light. Thereafter, the experiment could be interrupted conveniently for any period of time by turning off the overhead light.

A red lamp, called the pre-time-out or pre-aversive stimulus, was then installed next to the key. The light appeared every 15 minutes for 160 to 180 seconds, depending on the animals' performance. If an animal pressed the key during the last 20 seconds of the pre-time-out period, a 60-minute time out followed; but if it did not press the key during the final 20 seconds, the red light terminated, and no time out could occur until 15 minutes later, when the pre-time-out stimulus reappeared.

Key presses were reinforced on a variable-interval schedule in which the first key press after varying periods of time was reinforced. The mean interval between reinforcements was 6 minutes, with a range between zero (successive responses) and 12 minutes.

Figure 1 contains an entire daily record, 6 hours long, representing the stable performance after several hundreds of hours of exposure to the experimental procedure. Responses are cumulated against time, and the diagonal strokes on the curve indicate the start and end of the pre-time-out stimulus. The performance was recorded continuously; however, to facilitate inspection of the performance during the pre-time-out stimulus, the curve was broken into 15-minute segments with the pre-time-out period in the middle. The grid in the lower right part of the figure gives the coordinates, the scale of the record, and several reference slopes in responses per second. The reinforcements are not shown on the curve.

The resulting performance with the time out as the aversive event closely parallels the data reported by Azrin. The aversive properties of the time out appeared as suppression of the key-pressing during the pre-time-out stimulus. The degree of suppression ranged from the performance in the fourth segment of the second column, where suppression is complete, to the performance in the preceding segment, where the chimpanzee stops pressing the key only during the last 35 seconds. In most cases the chimpanzees pressed the key during the early part of the pre-time-out stimulus at the rate of responding that generally prevailed elsewhere, but they stopped abruptly some time before the final 20 seconds, when a response would produce a time out. Time outs occurred in approximately 3 percent of the pre-time-out stimuli. In the session represented in Fig. 1 a time out occurred at the arrow.

The suppression of the base-line behavior by the stimulus preceding the time out from the variable-interval schedule of reinforcement establishes the time out as an aversive event having properties similar to those of electric shock. The time out as an aversive event can be extrapolated to most aversive control in human behavior, where noxious stimuli such as corporal punishment or electric shock are rarely used. On the other hand, positive reinforcement is frequently discontinued, as in fines, disapproval, or incarceration. The important feature in such types of control is that an individual is punished by the withdrawal of the reinforcements for significant segments of his behavioral repertoire. Such withdrawal is similar to the time out of the present experiment.

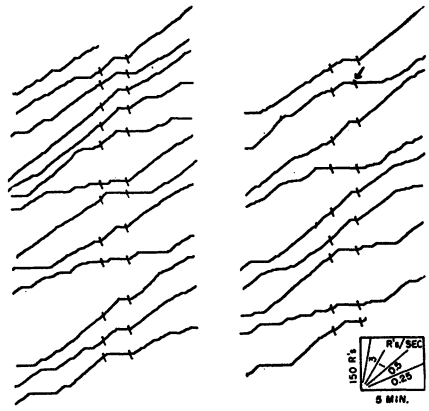

Fig. 1. Complete daily session showing suppression of key-pressing during the pre-time-out stimulus.

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Gamma Globulin Factors Protective against Infections from Pseudomonas and Other Organisms

In mice rendered susceptible to *Pseudomonas aeruginosa* infections by pretreatment with cortisone or by extensive thermal trauma, human gamma globulin (GG) administered after the infection was shown to be highly active in preventing death (*1*). The nature of