sampled from top to bottom, except for 2.7 m (9 ft) at the base which was covered by slump. Ten samples were taken, covering intervals ranging from 1 m (40 in.) to 2.7 m (9 ft). The base of the shell bed was about 7 m (23 ft) above the water level at high tide. About 91.7 m (300 ft) west of the sampled section were freshly slumped blocks which had been broken away from the bluff probably 3 to 4 weeks previously during heavy rains. The shell bed was clearly seen on all sides of the slumped blocks. It was also seen on the face of the bluff from which the blocks had broken away, at the same stratigraphic horizon as in the channelled section.

These exposures, which are probably better than those seen by previous workers, leave no doubt that the molluscan shell bed is definitely in place and was not washed up by high tides and storm waves. Table 1 is an abbreviated field description of the section sampled and its fossil content.

Thus, the upper 4.3 m (14 ft) of the bluff contained no fossils, either megascopic or microscopic. Foraminifera were first seen in the next 7 feet, ostracods were seen rarely, and only a single fragment of a pelecypod shell was seen. The shell bed yielded an abundant microfauna, and Foraminifera were also found in the 4.0 m (13 ft) sampled beneath the shell horizon.

At the present time, the only other sample examined came from clay at a depth of 4.6 m (15 ft) in an auger hole in SW¼ SE¼ SW¼ sec. 8, T13N, R3W, S.M., 0.24 km (780 ft) N10°W of Ship Creek bridge on Post Road. Foraminifera, *Elphidium* spp., were in this sample.

The ostracods and Foraminifera in the Bootlegger Cove Clay are characteristic of marine environments. The following species of ostracods have been identified: *Normanicythere* sp., *N.* cf. *N. macropora* (Bosquet), *N. leioderma* (Norman), *Loxoconcha* sp., *Trachyleberis* cf. *T. rastromarginata* (Brady), *Palmanella* sp., and *Cytheropteron* sp.

The ostracod fauna is comparable with that of the marine Gubik Formation of Pleistocene age on the North Slope of Alaska (*4*). Several species appear similar to those illustrated, but not described, by Swain. The genus *Normanicythere* has previously been described only from Arctic and North Atlantic environments (*5*). This is the first observation of *N. leioderma* from the Pacific. It is abundant in this collection, and abundant in Recent sediments from the western Atlantic, but it is rare in the Pleistocene in England.

The following Foraminifera in the Bootlegger Cove Clay have been identified by Joyce Mumby of Anchorage: *Quinqueloculina seminula* (Linné), *Guttulina lactea* (Walker and Jacob), *G.* sp., *Globulina* cf. *G. glacialis* Cushman and Ozawa, *Elphidium incertum* (Williamson), *E. incertum* (Williamson) var. *clavatum* Cushman, *E.* cf. *E. bartletti* Cushman, *Elphidiella groenlandica* (Cushman), and *Protelphidium orbiculare* (Brady). These species have been described previously from Arctic and North Atlantic areas (*6*).

The presence of this fossil microfauna, with North Atlantic and Arctic affinities, may indicate that at the time the waters were invading the Cook Inlet area and depositing the Bootlegger Cove Clay, there might have been a seaway between Siberia and Alaska, that permitted free interchange of the Arctic, Atlantic, and Pacific faunas (*7*). It may also indicate that the fauna had free access earlier in the Pleistocene, and developed separately in each area. Until more work is done in the northern Pacific, this question cannot be resolved.

The presence of undoubted marine microfauna found in place does seem to lend considerable weight to the opinion that part of the Bootlegger Cove Clay was deposited under marine shallow water, or estuarine conditions, rather than in a lacustrine environment (*8*).

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Conditioned "Anxiety" and Punishment Effects on Operant Behavior of Goldfish (Carassius auratus)

Abstract. *Hungry goldfish learned to press a lever for worms on a 2-minute variable-interval schedule of reinforcement. Lever pressing was suppressed in the presence of a flashing light by (i) pairing the light with a brief electric shock ("anxiety") and (ii) punishing the lever-pressing behavior with electric shocks.*

Operant behavior of hungry animals can be suppressed markedly in the presence of a previously neutral stimulus (visual or auditory) that has been regularly terminated with a brief electric shock (*1*). Another method for inducing suppression of lever-pressing behavior involves punishing with electric shock any lever response made during the presentation of a previously neutral stimulus (*2*). Both methods have been employed extensively in experiments utilizing cats, rats, and monkeys (*3*). Their potential value as tools for evaluating pharmacologic agents also has been reported (*4*).

The present report describes the development of suppression of the lever-pressing behavior of hungry goldfish. The experimental apparatus consisted of a large plexiglass feeder (*5*) patterned after one designed by Longo and Bitterman (*6*). By the operation of a solenoid, the feeder automatically discharged a worm (Tubifex) from one of a series of medicine droppers.

The experimental chamber was an aluminum cubicle without a bottom so that it could be placed over a fish tank. In the front wall of the cubicle were mounted three miniature, red-covered, 28-volt lamp bulbs (GE 313), which served as house lights to signal the start of an experimental session. The far wall of the tank was covered with a translucent sheet of plexiglass, behind which was mounted a 12-volt, 4-ca-power bulb. Illumination of the bulb served as a conditioned stimulus. The fish could be shocked through two plexiglass electrodes (about 21 by 28 cm) affixed at right angles to the

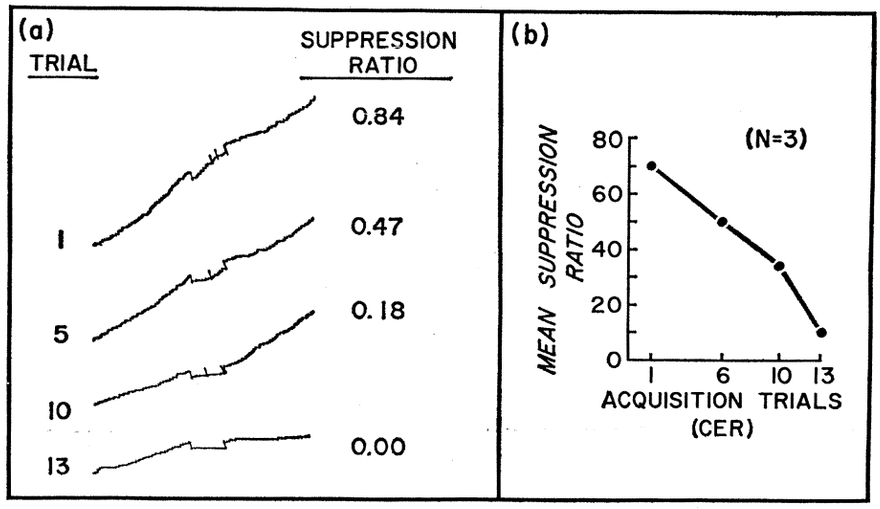

Fig. 1. Development of conditioned suppression of lever responding in the goldfish; (*a*) the degree of suppression in a typical fish during 3-minute flashing light (pen offsets) at successive stages of training; (*b*) average data for three goldfish.

inner roof of the experimental cubicle so that the distance between electrodes was about 11.75 cm. The inside surfaces of the electrodes were painted with a mixture of methyl ethyl ketone, styrofoam, and graphite (*7*). When the experimental cubicle was placed over the fish tank, these electrodes were immersed in the tap water (conductivity = approximately 5.5 grains) so that they extended the total length and height of the tank and the fish was between them at all times.

Also suspended from the inside roof of the experimental cubicle was the lever. This consisted of a piece of metal screening attached to the end of a thin metal rod that was mounted in the needle holder of a crystal phonograph cartridge. The cartridge was mounted to a wedge of plexiglass attached to the roof of the cubicle so that the lever was suspended in the water directly in front of the house lights. The output of the phonograph cartridge led to a high-gain amplifying-integrating system which has been described in detail (*8*).

Six goldfish, about 15 to 18 cm long, served as subjects. They were maintained in individual 9.5-liter (2.5-gal) tanks that were kept under constant aeration. The fish were deprived of food for approximately 2 weeks and were trained to press the lever to obtain the worms. Before introduction of the lever into the experimental situation, the feeder was activated periodically in order to accustom the fish to the feeding location as well as to the sound of the feeder. In cases where fish did not learn to press, a shaping procedure was used (*9*). After one session of lever pressing in which every lever response produced a worm, the schedule was changed so that reinforcements were obtainable after variable intervals which averaged 2 minutes. For three goldfish, the experimental sessions were conducted at the same time on Monday, Wednesday, and Friday of each week. After a fish had obtained 40 reinforcements, a session was terminated. When lever-pressing rates on the variable-interval schedule had become relatively stable, the conditioning was begun. At 15-minute intervals, a flashing light stimulus was activated for a 3-minute period. This stimulus was terminated with a brief 15-volt electric shock of 0.3-second duration. Each fish received four stimulus presentations during a lever-pressing session, but these were shock-reinforced only 50 percent of the time, in a mixed order.

Suppression of lever pressing during the conditioned-suppression period developed gradually over a number of trials (Fig. 1*a*). The suppression is given quantitative expression as suppression ratios, which were calculated by dividing the number of responses during the stimulus period by the number of responses during the 3-minute prestimulus period. A value of 1.00 or more would represent no suppression, while a value of zero would indicate complete suppression. Intermediate degrees of suppression would be expressed by values from zero to 1.00. As the top record shows, the suppression ratio on trial one was 0.84, which indicates relatively little reduction in response rate on the first stimulus presentation. A complete suppression was finally obtained on trial 13. Pre-light and post-light response rates also were reduced considerably, probably owing to a conditioning of some anxiety to the entire experimental environment. Average suppression ratios for three fish, shown in Fig. 1*b*, present essentially the same picture. The first point on the graph is lower than one might expect, possibly because one of the fish was somewhat averse to the light.

For a second group of three fish, experimental sessions of 2.5 hours' duration were conducted once each week. While these fish were lever pressing for worms on a 2-minute variable-interval schedule, light stimuli were activated at 45-minute intervals. These stimuli signaled a change in the rein-

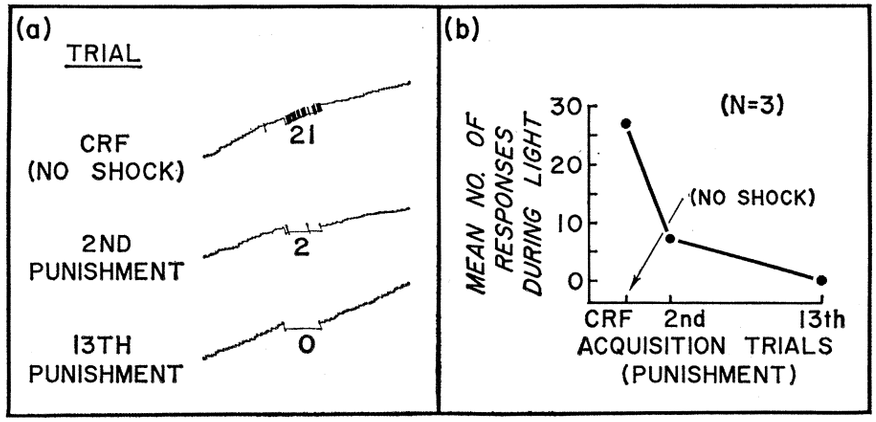

Fig. 2. Suppression of level responding by punishment; (*a*) illustrates the cessation of responses for a typical fish during 3-minute flashing light (pen offsets); (*b*) shows average data for three goldfish.

forcement schedule from the 2-minute variable interval to the more desirable continuous reinforcement. After a number of such stimulus presentations, a punishment contingency was added so that during the stimulus period the fish could get a worm for every lever response but also had to accept a shock. The shock intensity was 7 volts for 0.3 second. The development of the suppression for one of these fish is shown in Fig. 2*a*. The top record shows that the fish made 21 responses during a light presentation before the punishment contingency was added. The second cumulative record, which represents the second shock punishment trial, shows that the fish was willing to accept only two shocks in order to obtain the worms. The third record shows a complete suppression of lever responding approximately 11 trials later.

Similar data averaged for the three fish are shown in Fig. 2*b*, which shows that under continuous-reinforcement conditions without shock, the mean response rate was 27. On the second punishment conditioning trial, this was reduced to 7. By trial 13, suppression was complete in the three fish during the light period.

The results of this study demonstrate that the conditioned "anxiety" procedure and the punishment technique may be applied to goldfish with the same results that have been observed in other species (*10*).

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Teratogenic Effects of Meclizine Hydrochloride on the Rat

Abstract. *Congenital malformations were induced in the offspring of pregnant Sprague-Dawley rats by the administration of relatively large doses of meclizine hydrochloride (Bonine). The critical period of gestation for administration was from the 12th to 15th day. Anomalies were produced in the tongue, palatal closure, mouth, lower jaw, vertebrae and limbs.*

Recent reports concerning meclizine and human fetal abnormalities are contradictory. Some authors have reported a direct positive correlation between its administration during gestation and abnormalities in the fetus (*1*), while others have found no correlation (*2*). Reports on the effects of antihistamines in pregnancy and pseudopregnancy in the mouse and rat are also contradictory. Goldstein and Hazel (*3*) found that the antihistamine, "Pyranisamine maleate, administered daily by subcutaneous injection to female mice, in a dosage sufficient to cause marked and prolonged sedative effects, did not interfere with normal ovulation, fertilization or implantation." Shelesnyak and Davies (*4*) found that subcutaneous injection of benadryl in mice and pyrrolazote in rats significantly reduced the number of normal pregnancies and concluded that the antihistamines acted on the developing fetus after implantation had occurred. Finally the report of Tuchmann-Duplessis (*5*) at the University of Paris, on the teratogenic effect of cyclizine on laboratory animals, led the Wellcome Foundation of London, England, to advise the Ministry of Health on the possible teratogenicity of the antihistamine.

In the light of these reports it was decided to investigate the effects of meclizine hydrochloride (a compound of very close chemical structure to cyclizine) on fetal development in the rat, as part of an effort to obtain an agent which might specifically induce oral facial malformations.

"Bonine," a preparation of meclizine hydrochloride which is available commercially without prescription, was tested for teratogenic activity on the Sprague-Dawley rat. Tablets were pulverized and force fed by intubation as a suspension in 50 percent by volume of ethanol in water at different stages of gestation. At no time did the volume that was force fed exceed 1 ml. The excipient used in the preparation of the meclizine hydrochloride tablets (Bonine) was used for control purposes.

Three hundred and twenty mature female rats weighing 200 ± 20 g were used for this study. The onset of gestation was established by the demonstration of spermatazoa in vaginal smears. The day following the appearance of a positive smear was recorded as the first day of pregnancy.

Since our purpose was mainly the induction of cleft palate or oral facial malformations, the treatments were limited to the first 16 days of gestation. Emphasis was placed on the 12th to the 15th day, since it has been established by Feild *et al.* (*6*) that the 13th to the 15th gestational days are the critical periods of palatal development and closure in this strain of rats.

One day prior to the expected day of parturition the pregnant rats were killed with sodium nembutal. The young were delivered by cesarean section and examined for gross malformations. They were fixed in 80 percent ethanol, cleared with 1 percent KOH and the skeleton was selectively stained with 0.5 percent Alizarin Red S after which the specimens were examined for skeletal defects.

Fifty-six pregnant rats were used to determine the effects of multiple doses of 50 mg of Bonine per rat after implantation had occurred. Multiple doses before the 11th or after the 13th day produced no malformations. The critical time for two consecutive treatments

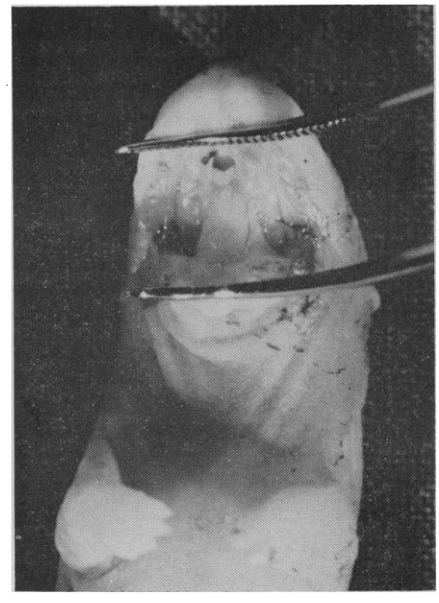

Fig. 1. Offspring with cleft palate and fusion of the tongue to the palatine shelves.