cylinder axis i.e. the direction of compression. The X-ray diagrams of these wedges were taken in a flat-plate camera using MoK α-radiation and 6 cm sample to film distance. The majority of the diagrams showed that 020 and some other reflections of gypsum had intensity variations along the Debye circles. The intensity variation along the circle for the 020 reflection was estimated visually by means of a calibrated intensity scale, and the ratio of maximum to minimum was taken as a measure of the preferred orientation.

The Table shows the types of results so far obtained. A moderate static load produces no preferred orientation within the period studied; whereas a moderate dynamic load does. An off-axial cyclic loading can produce different degrees of preferred orientation at different parts of a cylinder.

Other experiments, not shown in the Table, indicated that the degree of orientation, for a given length of stressing, increases with the higher content of plaster of Paris in the specimen at the beginning of the experiment. Thus alternate stressing seems to be more effective during primary crystallization than later when it requires a recrystallization of the primary crystals.

The observed orientation of the gypsum crystals is such that their *b*-axes are preferrentially oriented parallel with the direction of compression. The reason may be that the preferred habit of gypsum crystal is tabular in the direction of the *ac*-plane, and more or less elongated along the *c*-axis. Crystals in the observed orientation will have less strain and lower solubilities for a given load than those in other orientations. Thus cyclic compression can induce selective dissolution and prolonged exposure to this treatment is likely to lead to the observed preferred orientation in the polycrystalline gypsum mass.

The most interesting result is that an off-axial loading, in spite of the stress distributing metal disc, can produce different degrees of preferred orientation at different parts of a cylinder. These results are similar to those found in human bone where anterior and posterior parts have different degrees of preferred orientation[1] and may have a similar explanation.

*Résumé.* Afin d'aider à comprendre la forme des agrégats orientés des cylindres de plâtre de Paris durcis ont été soumis à une tension cyclique. L'expérience a permis de constater qu'il est possible d'obtenir un degré différentiel d'orientation dominante autour de la circonférence, comme dans le fémur humain, en soumettant des cylindres creux à des pressions cycliques excentriques.

S. CHATTERJI[2,3]

*Inorganic Chemistry Laboratory,*
*Landbohøjskolen,*
*Copenhagen (Denmark);*
*and*
*H+H Industri A/S, Lundtoftevej 1A,*
*DK–2800, Lyngby (Denmark),*
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[3] Permanent address: H+H Industri A/S, Lundtoftevej 1A, DK-2800 Lyngby (Denmark).

## Hypothalamic Self-Stimulation During Light Anesthesia in the Rat

In the classical experimental situation of self-stimulation, an animal presses a lever in order to self-administer 'rewarding' electrical stimuli through implanted brain electrodes. To assess effects of pharmacological depressants or brain lesions on reward or learning capability, the use of lever pressing as the operant response leads to difficulties in interpretation, since perceptual-motor deficits are confounded with possible effects on learning or reward mechanisms. For studying self-stimulation under light anesthesia we used, therefore, electrical muscle activity as a simple operant response.

Bipolar stainless steel electrodes, insulated except across the 0.2 mm tip, were implanted in the lateral hypothalamic area of anesthetized, adult, male albino rats. After recovery from the operation, the animals were tested for self-stimulation by lever pressing (stimulus parameters: 0.1 sec trains of 60–100 Hz sinewaves, 30–80 µA current intensity). In those animals who exhibited self-stimulation, 2 bipolar, tefloncoated electrodes (diameter: 75 µm) with gold-plated tips were implanted in the right and left supraspinatus muscles, using a method described previously[1]. The electrodes were led subcutaneously to the skull and crimped to a connector cemented to the skull. Experiments were started after recovery from the second operation.

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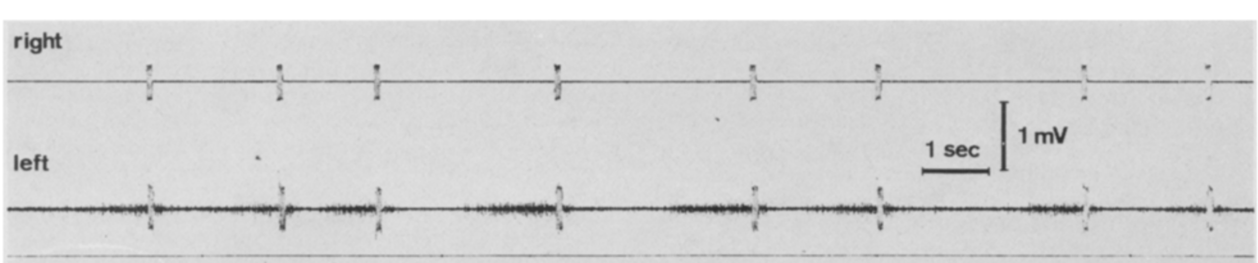


Self-stimulation in a rat under light pentobarbital anesthesia (21 mg/kg i.p.). The records show electrical muscle activity recorded from the right and left supraspinatus muscle. Large excursions (stimulus artifacts) indicate onset and duration of rewarding hypothalamic stimuli. Reward was made contingent on high activity in the left concurrent with low activity in the right group of muscles.

The Figure illustrates self-stimulation during light pentobarbital anesthesia. The rat was lying on its side after having lost its righting reflex, but still withdrew the extremities to painful stimuli. 'Rewarding' brain stimulation was made contingent on producing in one group of muscles motor potentials, whose amplitude and number within a period of time exceeded a preset level, while in the contralateral group of muscles the number of discharges had to remain below a critical level. In the experiment illustrated, the rat was 'rewarded' for producing at least 96 motor potentials exceeding a certain minimal amplitude within 3 sec in its left supraspinatus muscle, while during the same interval producing not more than 2 potentials in its right set of muscles (brain stimulation is indicated by the stimulus artifacts). The rat maintained self-stimulation for several minutes at a rate of 1 stimulus per 1–3 sec. Brain stimulation was generally succeeded by a silent interval, whereupon motor activity increased progressively until reaching the criterion. Discontinuation of brain stimulation was followed by a rapid decrease and disappearance of motor activity, indicating extinction of the response. Control periods using non-contingent hypothalamic stimulation ruled out the possibility that the stimulus per se induced the motor response. The training procedure consisted of first inducing a muscle discharge by pinching of a paw, then selectively reinforcing a low rate of discharge, and gradually increasing the muscle activity criterion by shaping. Self-stimulation during anesthesia was observed in 14 experiments conducted with 6 animals, the criterion for anesthesia being the loss of the righting reflex.

We have shown in previous experiments[2,3] that operant conditioning is still possible after ablation of major forebrain structures. The present observations extend those findings in showing that operant conditioning by hypothalamic stimulation is also relatively resistant to anesthesia.

*Zusammenfassung*. Ratten zeigen unter leichter Pentobarbitalnarkose ein Selbstreizverhalten, wobei sie die «belohnenden» Hirnreize durch Kontraktion bestimmter Muskelgruppen auslösen. Das Lernverhalten scheint demnach zu jenen Gehirnfunktionen zu gehören, die durch Narkose relativ wenig beeinträchtigt werden.

H. V. LÖRCHER, A. A. BORBÉLY, P. G. WASER and J. P. HUSTON[4]

*Institute of Pharmacology, University of Zürich, Gloriastrasse 32, CH–8006 Zürich (Switzerland), 10 January 1974.*

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## Ambiguous Effect of Caffeine Upon the Transmembrane Ca Current in Mammalian Ventricular Myocardium

Besides its inotropic actions, caffeine markedly prolongs the action potential duration in the mammalian myocardium (KIMOTO[1]) and induces an increase of the upstroke phase of the Ca-mediated action potentials (VERDONCK, BUSSELEN and CARMELIET[2]). This suggests that caffeine increases the Ca conductivity of the membrane, which could be one reason for the augmentation of contractile activity. In order to obtain a more precise insight into the caffeine-induced changes in Ca movements, the transmembrane Ca inward current was measured under voltage clamp conditions on isolated trabeculae and papillary muscles of the right ventricle of cats.

*Methods*. Voltage clamp experiments were performed using the double sucrose gap technique which has been described in detail previously[3]. To separate the slow Ca current from the fast Na current, the latter was inactivated by decreasing the resting potential by 30–50 mV. When the membrane was further depolarized from this lowered potential, the slow Ca current was elicited (REUTER and BEELER[4]).

*Results and discussion*. The transmembrane Ca current is markedly changed by caffeine. Figure 1 shows a typical experiment. In normal Tyrode solution with a Ca concentration of 2.2 m*M* a membrane depolarization of 70 mV triggered a Ca current of 5 μA. After 5 min of exposure to 20 m*M* caffeine, the same membrane depolarization produced a current of 11.6 μA. The current voltage relationship curve was shifted to stronger currents. In 6 other experiments, the same response was obtained and an increase in current of about 100% was observed occuring 3–8 min after the addition of the caffeine (20 m*M*) to the Tyrode solution. The augmentation in current indicates an increase in the Ca conductivity of the slow membrane channel. This caffeine effect resembles that of the catecholamines, which are knwon as very effective promotors of the Ca conductivity of the membrane, and results in a potentiation of the Ca supply of the myocardial cell. But when the time of exposure to caffeine was prolonged, the increase in Ca current did not persist. At the end of this period of persistence of the increased but constant Ca current, a gradual decrease began to occur. In the experiment, shown in Figure 1, 25 min after the addition of 20 m*M* caffeine to the Tyrode solution, this slight decrease of the Ca current was observed. Then, in the subsequent 30 min, the fall became more and more evident. Finally after 55 min the constant depolarization of 70 mV produced a Ca current of only 0.5 μA. Similarly in all the other 6 experiments, the final Ca inward current was less than the control value in normal Tyrode solution. This diminution in current was accompanied by a decrease in reversal potential. In the early phase of this second period of caffeine action, the Ca current can be temporarily restored by interruption of the continuous stimulation (Figure 2). The first Ca current elicited after a resting period of about 1 min was found to be augmented. Subsequent stimulations produced a staircase-like decrease in current so that, 4–6 pulses later, the current magnitude was similar to this existing before the interruption of stimulation.

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