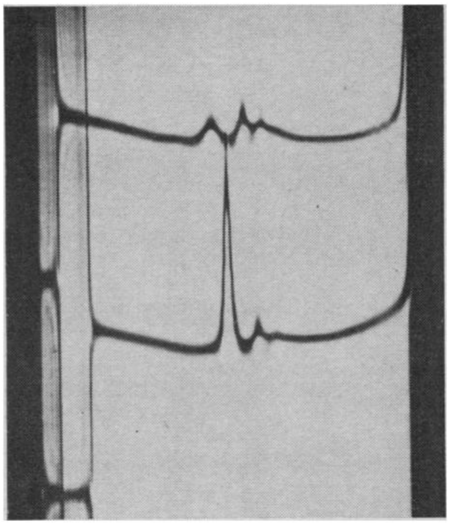

Fig. 2. Ultracentrifuge diagrams of myosin titrated to 5.5 moles of methylmercuric hydroxide per $10^5$ grams of protein. Top, control; bottom, myosin solution made 1 m*M* in pyrophosphate before the addition of methylmercuric hydroxide. Protein concentration 0.5 percent; temperature 20°C; exposure made 67 minutes after reaching 59,780 rev/min, bar angle 50°, sedimentation from left to right.

$Ca^{++}$-activated adenosine triphosphatase activity occurs, a molecular transformation process also takes place (*5*). In the ultracentrifuge diagram, the sharp peak of myosin is transformed into a faster peak; the adenosine triphosphatase activity is directly proportional to the amount of slow, myosin peak. I proposed (*5*) that binding of mercurial reagent to the strategically situated sulfhydryl group caused a conformational change which reversibly both destroyed adenosine triphosphatase and caused an aggregation. With the same experimental system, I have explored the concept that ATP and pyrophosphate protect myosin not by binding to the active site but by preventing a conformational change.

In the presence of ATP and pyrophosphate, the usual activation of the $Ca^{++}$-activated adenosine triphosphatase of myosin occurs (Fig. 1) as methylmercuric hydroxide is added until about 3 moles per $10^5$ grams protein is reached; further addition of mercurial produces but slight inhibition. The adenosine triphosphatase activity depends upon its value when the methylmercuric hydroxide was added rather than upon the total amount of the mercurial reagent which is present.

To test the effect of pyrophosphate upon the molecular transformation process, a sample of myosin was titrated to 5.5 moles of methylmercuric hydroxide per $10^5$ grams of protein in the presence and in the absence of 1 m*M* pyrophosphate and examined in both a regular and a wedge cell in the analytical ultracentrifuge. In the control sample lacking pyrophosphate (Fig. 2, top), most of the myosin has been transformed into faster-sedimenting products. In the sample that contains pyrophosphate (Fig. 2, bottom), the sharp myosin peak is largely intact.

Several schemes for explaining these interactions are possible, each based on Koshland's treatment of conformational changes involving active sites (*6*); one such speculation is presented in Fig. 3. Region II is potentially inhibitory (Fig. 3*A*). Upon binding of mercurial reagent to the strategic sulfhydryl group, region II encroaches upon the active site and disrupts it (Fig. 3*B*). Binding of polyanion either imposes restrictions on the conformational change possible for region II or imposes steric hindrance making the sulfhydryl unavailable (Fig. 3*C*). Conceivably this one sulfhydryl group does not exchange with bis-β-carboxyethyl disulfide (*4*) because the reagent is a polyanion which reacts with the same groups as ATP and pyrophosphate and confers similar protection.

The prevention by ATP of a conformational change in myosin is in agreement with the stabilizing action of ATP on G-actin which has been studied by Katz (*7*). There are also resemblances to more remote systems such as beef kidney membrane, which is protected by ATP against diisopropylphosphorofluoridate inhibition (*8*).

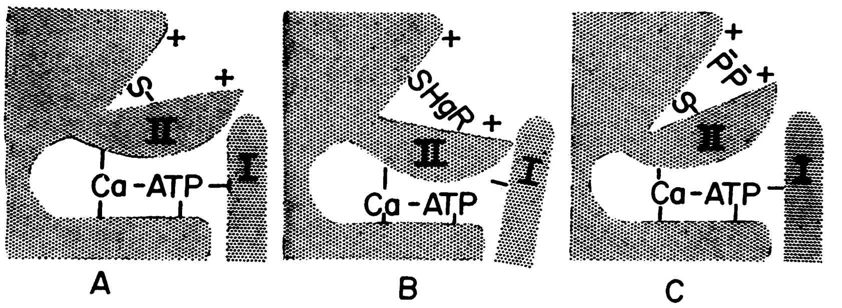

Fig. 3. Possible conformational changes of $Ca^{++}$-activated adenosine triphosphatase region of myosin.

**David R. Kominz**

*National Institute of Arthritis and Metabolic Diseases, Bethesda, Maryland*

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## Role of Orbital Cortex in Regulation of Thalamocortical Electrical Activity

Abstract. *The orbital region of the cortex in the cat is essential to the occurrence of spontaneous spindle bursts and thalamically induced recruiting responses, observed in both cortex and thalamus. Ablations of the entire dorsal convexity, and of the mesial and cingulate regions of the cortex, failed to interfere with the spindle bursts and recruiting responses, whereas ablations confined to the orbital cortex alone abolished completely these potentials in the cortex and thalamus. Therefore, the orbital cortex appears to be the only region of the neocortex to play a crucial role in the regulation of thalamocortical synchronizing and integrating functions. These functions are believed to be associated with a nonspecific system governing internal inhibition which manifests itself in inattention, drowsiness, and sleep.*

Two kinds of electrocortical activity are known to be dependent upon thalamocortical relationships: (i) spontaneous, spindle-shaped envelopes of 8- to 10-cy/sec waves known as "spindle bursts" (*1*) and (ii) recruiting responses induced by repetitive stimulation of the thalamus (*2*). Thalamocortical interrelationships have been postulated to explain both spindle bursts (*3*) and recruiting responses (*4*).

During cortical ablation experiments to further clarify thalamocortical relationships, it was discovered that ablations of the orbital cortex only could block the appearance of spindle bursts and recruiting responses in both thalamus and cortex.

These experiments were performed on 18 cats immobilized with Flaxedil. Surgical procedures, carried out under ether anesthesia, consisted of routine tracheotomy, vein cannulation, and extensive craniotomy. All cut surfaces and pressure points were injected with procaine hydrochloride before discontinuance of the ether anesthesia and repeatedly thereafter. The animal was maintained under artificial respiration. Electrical recording was by means of a Grass model 3, eight-channel electroencephalograph (EEG) and Tektronix 502 oscilloscope coupled with Tektronix 122 preamplifiers. Stimulation was delivered by a Grass S4 stimulator through an SIU-4 isolation unit. Stimuli were square-wave pulses of 0.5-msec duration, ranging from 2 to 4.5 volts in intensity, and at 8 cy/sec. Stimulation was through bipolar side-by-side electrodes with uninsulated tips separated by 1 mm. Recording was monopolar in all cases with the stereotaxic frame serving as a reference lead. Deep recordings were by single stainless-steel shafts uninsulated for 1 mm at the tip; cortical recordings were from silver ball tips applied to the pial surface.

Recruiting responses were produced by low-frequency stimulation of the midline nuclear complex of the thalamus (nucleus centrum medianum, centralis medialis, ventralis anterior, and reticularis). Spindle bursts were induced by lesions in the mesencephalic reticular formation at the level of the superior colliculi (*3*). Both recruiting and spindling were recorded on the surface of the cortex (anterior and posterior sigmoid and suprasylvian gyri), in subcortical white matter, and in the thalamus.

Cortical recruiting responses were incremental, monophasic, negative potentials with latencies over 25 msec. Recruiting potentials in the white matter and the thalamus exhibited characteristics similar to those of the cortex, but with opposite polarity (*5*).

Spindle bursts were composed of 8- to 10-cy/sec waves and occurred at fairly regular intervals, simultaneous and concurrent in cortical and subcortical recordings.

Three kinds of cortical ablations were performed. The first involved most of the primary, specific, sensory areas (visual, auditory, and somatosensory); the second included the motor cortex and most of the associative cortex (suprasylvian and cingulate gyri); the third was limited to the orbital cortex. These three kinds of ablation were performed either successively, in the order first given, or individually. Following the first two kinds of ablation, spindle bursts and recruitment were increased. Contrastingly, ablation of the orbital cortex, though much more limited in extent of tissue removed, suppressed completely the recruiting waves and spindle bursts in the thalamus and on other parts of the cortex (Fig. 1). This effect persisted for 3 to 6 hours, after which observations were discontinued. The ablated area included the anterior sylvian convolution, the prepiriform area, and the olfactory tubercle. This critical area is bounded anteriorly by the gyrus proreus, posteriorly by the posterior sylvian and piriform cortex, medially by the anterior limbic area, and superiorly by the internal capsule.

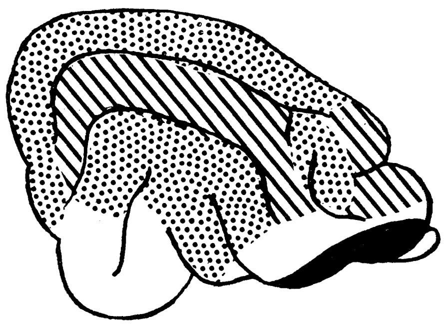

Fig. 2. Diagram of cat brain showing locus and extent of decortication. Stippling, primary sensory areas; hatching, association areas, including cingulate gyrus on mesial surface not shown; black, orbital cortex; white, cortical areas not removed.

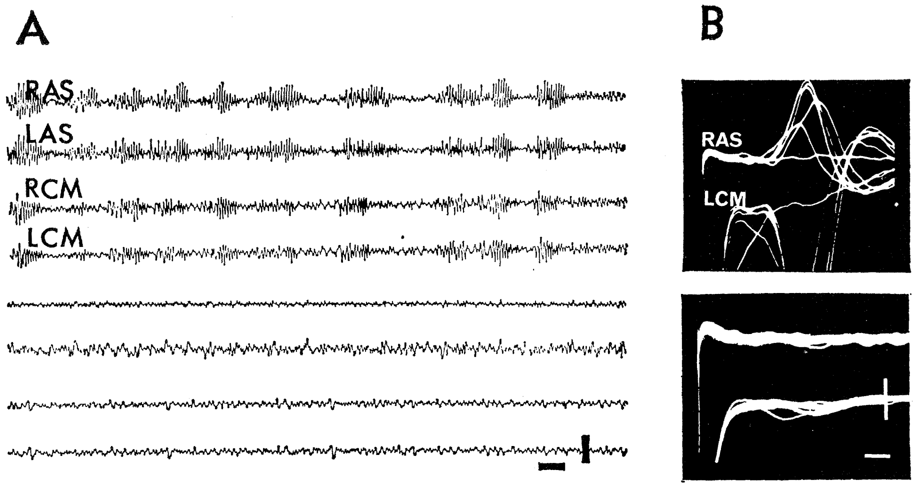

Fig. 1. Effect of ablation of orbital cortex upon spindle bursts and recruiting responses in cortex and thalamus of the cat. (Top) *A*, Spontaneous spindle bursts occurring in cortex (*RAS, LAS*, right and left anterior sigmoid gyri) and thalamus (*RCM, LCM*, right and left nucleus centrum medianum) after lesion of mesencephalic tegmentum. Note simultaneity of bursts in right and left cortical and thalamic recording sites. *B*, Recruiting responses induced by repeated stimulation of right centrum medianum (*RCM*) while recording in right anterior sigmoid gyrus (*RAS*) and in left centrum medianum (*LCM*). (Bottom) Blocking of spindle bursts and recruiting after ablation of orbital cortex bilaterally. *A*, All spindle bursts have disappeared from the spontaneous EEG record; *B*, recruiting responses are absent in *RAS* and *LCM*. Calibrations: EEG records: time, 1 second; voltage, 400 $\mu$v; oscilloscope records: time, 20 msec; voltage, 200 $\mu$v.

In the majority of the animals the preoptic and septal regions, the caudate nuclei, and fibers of the anterior commissure remained intact. Unilateral ablations attenuated, but did not abolish, ipsilateral or contralateral recruiting responses and spindling activity. Therefore, it is assumed that the orbital cortex has an essential role in the development of recruiting and spindling activity in the cortex as well as in the thalamus. The blocking of spindling and recruiting, by orbital ablation, was unexpected on the basis of the literature (*6*). Comparable results have been obtained only after lesion of the nucleus ventralis anterior of the thalamus (*7*). These results could not be duplicated by ablation of the entire dorsolateral convexity of the cortical mantle, including the mesial surface and the cingulate gyrus; only an orbital area lesion produced the blocking effect (Fig. 2).

The locus of the ablation which is

effective in disrupting the thalamocortical relations seems to be a part of a system which passes anteriorly, from the medial group of nonspecific thalamic nuclei, through the nucleus ventralis anterior and thence to the orbital cortex. The exact role of the orbital portion of this thalamocortical system is not known, but previous workers have presented neuroanatomical and electrophysiological evidence of thalamo-orbital relationships (*8*). Additionally, Magoun (*9*) has called attention to the fact that the frontal lobe, and particularly the orbital region, may be involved in an inhibitory role. He cites results which "point to the existence of a nonspecific, thalamo-cortical system, the low-frequency excitation of which evokes large slow waves as well as recruiting responses and spindle bursts in the EEG. These characteristically bear a close relation to internal inhibition, behavioral drowsiness and sleep, although they can display dissociation from such behavior." The blocking of recruiting responses and spindle bursts, as shown by our results with orbital lesions only, suggests that it is such a system which we are interrupting.

MARCOS VELASCO
DONALD B. LINDSLEY
*Departments of Psychology* and
*Physiology* and *Brain Research*
*Institute, University of*
*California, Los Angeles*

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# Solar Distillation of Water from Soil and Plant Materials: A Simple Desert Survival Technique

Abstract. *Water obtained from soil and plant materials by a simple distillation technique can provide a means for survival under desert conditions. A hemispherical hole in soil (in some cases containing cut plant material) is covered with plastic film formed and held in a conical shape by a rock placed in the center. Water collects on the under side of the plastic, runs to the point of the cone, and drops into the container. A yield of 1.5 liters per day of potable water was obtained from a single "survival still."*

People stranded in desert areas are frequently without a source of water. We propose a simple technique that utilizes solar energy to distill potable water from soil and plant materials. The component parts of our "survival still" are a piece of clear plastic about 2 × 2 m, either square or circular, and a container in which to collect water. The container should have a wide mouth, say 15 cm in diameter, and a capacity of 2 to 4 liters. In emergencies, a container can be fashioned of plastic film, aluminum foil, or other waterproof material, with small rocks being used for support. A convenient, but not essential, component is plastic tubing, 1.5 m long and about 5 mm in internal diameter. With the tubing, water can be sucked from the container without disturbing the still. The essential components of the still can be folded to a pocket-sized package. A diagram of the survival still is shown in Fig. 1.

The principle of operation is the same as it is for conventional stills (*1–3*). Solar energy passes through the plastic and is absorbed by the soil or plant material, resulting in evaporation of water, followed by condensation on the cooler plastic. The condensed water runs down to the point of the cone and drops into the container, from which it is collected.

The still is constructed by digging a hemispherical hole about 1 m in diameter and about 0.5 m deep (Fig. 1). The center is excavated an additional 20 cm or so to receive the container. If the plastic tubing is used, one end is taped to the inside of the container and the other led out of the hole. The plastic cover is put over the hole and held in place with soil around the edge. The plastic is then pushed downward in the center to form a cone having an angle of 25 to 40 degrees from horizontal. A rock or other weight is placed in the center directly over the container to maintain the conical shape and reduce wind flutter. Additional soil is placed around the edge to hold the plastic firmly in place. The plastic film should be 5 to 10 cm above the soil in the hole and should touch the soil only on the rim of the hole. Construction time is from 15 to 30 minutes.

Table 1. Daily yield of water, in milliliters, from five survival stills located near Phoenix, Arizona. Stills 1 and 2 were in a loam soil with an initial water content of about 18 percent, and stills 3, 4, and 5 were in a desert sand containing 2 to 8 percent water at the time of installation. Rainfall, measured in Phoenix, was 34.3 mm during 1–12 April and 4.0 mm on 12 May 1965.

| Date | Loam soil | | Desert sand | | |
|---|---|---|---|---|---|
| | Still 1 | Still 2 | Still 3* | Still 4* | Still 5† |
| 21 April | 1340 | 900 | 710 | 470 | 180 |
| 22 April | 2080 | 1670 | 1310 | 1350 | 260 |
| 23 April | 1560 | 1360 | 1160 | 800 | 125 |
| 24 April | 1900 | 1675 | 1180 | 1000 | 190 |
| 25 April | 1685 | 1430 | 1030 | 790 | 120 |
| 26 April | 1800 | 1520 | 220 | 550 | 50 |
| 27 April | | 1460 | 770 | 475 | 120 |
| 28 April | 2100 | 1400 | 690 | 410 | 110 |
| 29 April | 1960 | 1300 | 485 | 260 | 65 |
| 30 April | 1830 | 1130 | 365 | 190 | 30 |
| 26 May | 1000 | 840 | | | |
| 23 June | 490 | 465 | | | |

* Located in a wash or depression where water would collect during a rain. † Purposely constructed in an unfavorable site—a coarse sand in which rain water rapidly drained away, leaving little water stored in the sand.