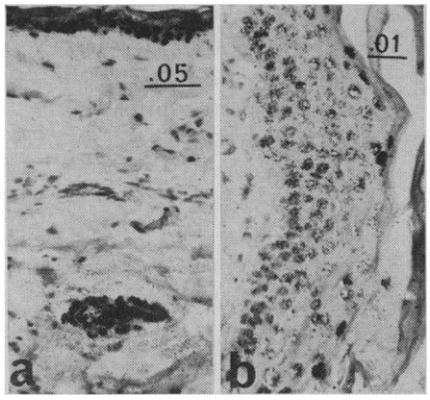

Fig. 2. Autoradiographs of skin labeled before transplantation. (Scales represent fractions of a millimeter.) (a) Skin immediately before grafting; silver grains, considerably in excess of background density, can be seen adjacent to the heavily labeled hair follicle and basal layer of the epidermis, suggesting that some labeled material may have been released by these cells. (b) Epithelium of the same skin 7 days after transplantation as an allograft: the initial heavy labeling of the basal cells has not interfered with the usual extensive proliferation of the epithelial cells.

mediately at the graft site, and that the effect of this exchange is stimulatory to DNA synthesis. Such transfer from an allogeneic tissue to host lymphoid cells may be an initial step in the induction of transplantation immunity.

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6. This transfer is presumably an exchange in both directions. Unlabeled skin grafts, placed on a previously labeled site, acquired a nuclear label. It is more difficult, however, to prove unequivocally that this was a local transfer, since cells of the lymph node draining the graft site were unavoidably labeled also, and label subsequently found in graft cells could have been brought there by circulating lymphoid cells exercising a trophic function (*13*).
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16 September 1966

Electrophysiologic Studies during Scanning and Passive Eye Movements in Humans

Abstract. *It has been demonstrated in man that mechanically induced shifts of the retinal image without change in total luminous flux evoke a parieto-occipital electrical response (lambda waves). The technique provides a simple method of quantifying responses in the visual system without complication by voluntary movements and their associated readiness potentials. The observation contradicts the view that lambda waves are directly concerned with mechanisms preventing blur during eye movement.*

Vision remains clear during eye movement, though the mechanism whereby this is achieved is subject to debate. A concomitant of eye movement is the appearance in the parietal region of positive potentials called lambda waves (*1*). It has been postulated (*2*) that these waves are concerned with antiblurring mechanisms during eye movements, since they regularly follow changes in fixation. The observation that passive displacement of the eyeball not only produced blurring of an image but also resulted in lambda waves has some interesting consequences for visual physiology, and was investigated in the following experiment.

Recording electrodes were attached to the parieto-occipital region, and an oculographic pair in a horizontal plane close to one eye. Potentials from the electroencephalographic electrodes were amplified and displayed on an ink-writing oscillograph as well as being summated by a Mnemotron CAT computer. The experimenter's finger, tapping the outer canthus of the subject's eye, produced a transient displacement of the eye; the resulting voltages, after direct-current amplification, were transmitted to the computer. A subject was required to fixate a point in the middle of an illuminated (30 mlam) stimulus card which bore a complex black-and-white picture known from previous work in this laboratory to be effective in producing lambda waves. A tap of this kind caused vertical images to be displaced laterally by about 1° of arc, with blurring; the accompanying electro-ocular transient was sufficient to trigger the computer.

Extensive investigations have been carried out on one subject (D.F.S.) and confirmed on two other subjects; one typical result is illustrated (Fig. 1). Figure 1A shows a clearly defined response with a peak positive latency of 130 to 150 msec resulting from displacement of the left eye. This response is very similar to that shown in Fig. 1C, which was obtained during voluntary monocular scanning of the stimulus card. Related to these averaged observations are insets A_1 and C_1 from the parieto-occipital electroencephalographic tracings. Lambda waves are clearly recognizable in both tracings, though they are larger and more frequent in C_1, where the eye was scanning rather than being moved passively.

Figure 1B is a control recording obtained by tapping the canthus in total darkness. It will be observed that the characteristic deflection of Figs. 1A and 1C did not occur. In addition there are no lambda waves in the electroencephalographic tracing (inset B_1). These results exclude the possibility that the responses shown in Fig. 1A are caused by skin or proprioceptive stimuli associated with passive displacement of the eye and the extraocular musculature.

It therefore appears that when the

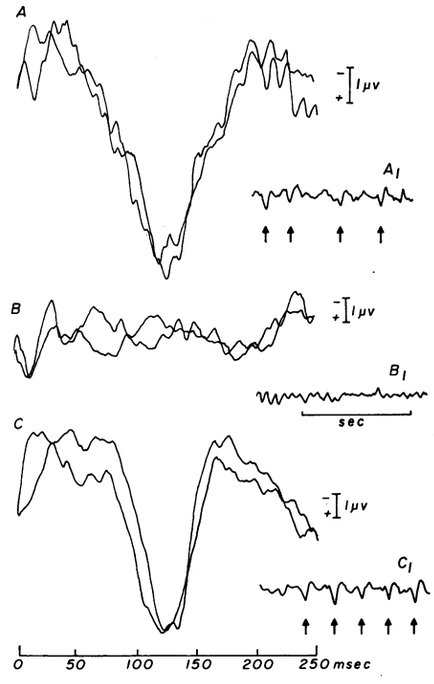

Fig. 1. Summated responses in parieto-occipital region, two sets, of 20, superimposed (subject D.F.S.). (A) Response to tapping of outer canthus of left eye during fixation on complex stimulus card. (B) Response to similar tapping of eye in darkness. (C) Response to scanning of complex stimulus card. Insets A_1, B_1, and C_1 show electroencephalographic tracings, with lambda waves indicated by arrows.

pattern falling on the retina is altered by passive displacement of the eye or by scanning eye movements, lambda waves are produced. In the latter circumstance, there is no blurring of the visual image; but in the former, blurring does occur. Hence, lambda waves are unlikely to be concerned directly with the mechanism for suppression of blurring during eye movement.

This simplified method of stimulation of the visual system is of interest because it obviates change in total luminous flux as well as the complication of voluntary movement of the eyes. Such voluntary movement may lead to difficulties, as is indicated by some other recent studies in which we have observed that changes in the potential are already occurring in the cortex at the time of or just before eye movement. These may be similar to the readiness potentials (*3*) which occur in association with voluntary movements of the limbs.

After considerable investigation, we believe that the lambda response is more closely related to the visually evoked potential than to inhibitory mechanisms in effect during scanning eye movements.

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7 October 1966

Recovery of Memory after Amnesia Induced by Electroconvulsive Shock

Abstract. *Electroconvulsive shock given to rats immediately after one-trial avoidance learning produced a significant amnesic effect 24 hours later; this amnesia had largely disappeared in further retention tests 48 and 72 hours after treatment. This result puts in question a basic assumption implicit in most memory consolidation studies that such amnesic effects will be permanent.*

Animals given an electroconvulsive shock (ECS) shortly after a single avoidance learning trial will show little or no evidence of learning when tested 24 hours later (*1*). The usual interpretation of this effect is that the ECS has disrupted certain neural processes essential for the establishment of a memory trace. Such an interpretation is based on the assumption that any amnesic effects of this sort will be permanent: for, if ECS has effectively prevented the formation of a memory trace by occurring within the critical period required for this process, then the retention deficit observed 24 hours after treatment should be equally apparent at any other time of testing. Apart from an early experiment by Worchel and Narciso (*2*) and a more recent one by Chevalier (*3*), this assumption has never been systematically examined, yet it is of critical importance for memory consolidation theory.

Worchel and Narciso tested rats 4 days after a series of six massed ECS treatments were administered immediately after a criterion learning trial. The rats showed no impairment in relearning a 14-unit T-maze, although significant impairment had been noted when the rats were tested 24 hours after treatment (*4*). While these results were attributed by the authors to the temporary retroactive effects of the treatment, they could equally well have been due to the temporary proactive effects of the massive dose of ECS used in this experiment, or to a combination of both effects. Chevalier was unable to find any differences in the extent of amnesia for a nonspecific avoidance response (reduction of locomotor activity in an apparatus where shock had been given) in different groups of mice tested 1, 7, or 30 days after a single footshock-ECS treatment; he concluded that the amnesia was permanent. However, the results of the following experiment indicate that under certain conditions there can be a dramatic recovery from the retroactive effects of ECS. In this experiment ECS was administered after footshock consequent upon a step-down response, the interval between footshock and ECS was three-fifths of a second, and all animals were tested for retention 24, 48, and 72 hours after treatment.

Subjects in the experiment were 124 male albino rats of the Wistar strain, aged 90 to 100 days. Each cage housed 4 or 5 rats with free access to food and water. The apparatus was similar to that first described by Jarvik and Essman (*5*). It consisted of an uncovered 44 cm square compartment with walls 46 cm high, made of aluminum lined with matt black plastic. The floor was constructed of stainless steel rods (0.24 cm in diameter) set 1.27 cm apart. In the center was a 9-cm square platform raised 7.5 cm above the grid floor and illuminated from above by a collimated light source. Footshock could be delivered through the grid floor for 2.0 seconds by means of a scrambler delivering 10 pulses/sec to each rod at approximately 0.4 ma. The ECS (50 cycles a-c at 35 ma for 0.20 second) was administered by way of modified crocodile-clip ear electrodes from a constant current machine using the principle of the Pittsburgh electro-shock apparatus (*6*).

In each daily trial earclips were attached to each rat; it was then placed on the platform and its step-down latency (that is, the time spent on the platform) was recorded to within .01 second. On the first 3 days preliminary training trials were given in which the rats were permitted to explore the apparatus for approximately 10 seconds after stepping down. On the 4th day differential treatment was given as follows: Group 1 (FS, $n = 34$) received 2.0-seconds footshock through the grid floor immediately on stepping down from the platform; Group 2 (FS-ECS, $n = 40$) received immediate footshock, followed 0.6 second later by ECS; Group 3 (ECS, $n = 24$) received ECS only, 2.6 seconds after stepping down; Group 4 (NT, $n = 26$) received no treatment after stepping down. All ECS animals were removed from the apparatus while still unconscious and they recovered in their home cages; the other animals were returned to their home cages after approximately 10 seconds on the grid. On each of the three subsequent days retention trials were given with the same procedure as had been used in the preliminary training trials.

The usual criterion of retention in a step-down experiment is the length of time animals remain on the platform the day after footshock treatment (here termed step-down latency). In our experiment there was considerable variation in the post-treatment step-down latencies of the FS group,