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Focal epileptogenic lesions induced in monkeys by means of alumina cream implantation over selected isocortical structures result in deficient acquisition of certain behavioral tasks, but do not disrupt the memory for these tasks after they have been learned. In previous investigations monkeys with epileptogenic discharges from lateral frontal cortex were found deficient in learning delayed alternation tasks (Stamm and Pribram, *4*), and those with implants over occipital (Kraft *et al.*, *3*) or inferotemporal cortex (Stamm and Pribram, *5*) learned visual discrimination problems at retarded rates. However, no learning deficits were obtained on visual discriminations by frontally epileptoid monkeys or on delayed alternation tasks by monkeys with occipital or inferotemporal implants.

Bilateral ablation of posterior parietal cortex in monkeys has been found to affect both the acquisition and the retention of somatosensory, but not of visual, discriminations (Wilson, *6*; Bates and Ettlinger, *1*; Wilson *et al.*, *8*). Consequently, it may be hypothesized that focal epileptogenic discharges from these cortical structures would result in retarded rates of acquisition of somatosensory discriminations, but would not disrupt the memory for those tasks learned before the onset of epileptogenic discharges. This hypothesis is investigated in the present experiment.

METHOD

Subjects. Two groups of immature monkeys were used, a *Learning Group* and a *Retention Group*. Each group consisted of five subjects — two were experimentally untrained rhesus monkeys and three were cynomolgus monkeys which has been used previously in a visual two-choice experiment (Wilson, *7*).

Operative procedure. Surgery was performed aseptically under nembutal anesthesia. After incision of the skin, openings were drilled bilaterally in the parietal bone and enlarged by rongeurs. The dura was cut in order to expose cortex between lunate and intraparietal sulci. Commercial amphojel, boiled to the consistency of a thick paste, was packed in silver disks, 9 mm in diameter. Four disks were placed over each hemi-

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sphere — one disk posterior to the lunate sulcus near the midline and three in front of the lunate sulcus, so that they covered cortex from midline to the upper portion of the superior temporal gyrus. The dura was sutured over the disks and overlying fascia and skin were closed in layers.

EEG recordings. Electroencephalographic recordings were taken preoperatively and then at monthly intervals. During a recording session the monkey was placed supinely in a tight wooden box and recording electrodes (wound clips) were attached to the scalp bilaterally over frontal, temporal, and parietal cortex, and over the vertex.

Histological procedure. After completion of the experiment the monkeys were sacrificed, the disks were removed, and the brains were processed for histological examination. Serial sections of the brains, stained with thionine, served for reconstruction of damaged cortical structures and for assaying degeneration in thalamic nuclei.

Apparatus. Somesthetic testing was conducted in the dark in a discrimination apparatus previously described (Wilson *et al.*, *8*), which was similar to the Wisconsin General Test Apparatus. The subject, in a portable testing cage, was presented with two cues which were separated by a two-inch space and situated eight inches above the floor of the testing cage. The cues consisted of half-round strips of wooden doweling (each 2″ long and 1″ in diameter) mounted on slides, flat side down, with the axes parallel to the front of the testing cage. All exposed surfaces were covered with sandpaper. Each block could be pushed against a spring of 3/4 lb. tension for a 1½ mm stroke. This locked the block in place and exposed a food cup beneath the slide.

For testing on delayed alternation and on visual pattern discrimination a Wisconsin General Test Apparatus, previously described (Stamm and Pribram, *4*), was used. The subject, in a portable cage, faced a testing tray on which two rectangular boxes were mounted, 12 inches apart. Each box was covered with a metal slide, which could be pushed forward to expose a food well. For the alternation task blank metal covers were placed over the food wells, while for the visual discrimination a cross was painted on one cover and the outline of a square on the other. Peanuts (½ per trial) were used as rewards.

TESTING PROCEDURE

Somesthetic discriminations. During preliminary somesthetic training the monkeys learned to jump into the testing cage, pick peanuts from open food wells, and push back blocks covered with coarse sandpaper (24 grains/inch). These trials were first conducted with a light on; then illumination was gradually reduced until the subjects performed in complete darkness.

All subjects were next tested on the *initial discrimination* between the rough (grade 24, rewarded) and very smooth sandpaper (grade 280). On this task and all subsequent somesthetic discriminations the screen concealing the cues from the subjects was lowered and raised in darkness. The rewarded cue was placed on successive trials at the left or right position according to a predetermined chance sequence. Auditory cues, resulting from changing the blocks and baiting the food wells, were randomized. Incidental auditory cues were further masked by the noise from an air cooler. On the initial discrimination 50 trials/day were given until the monkey responded at the criterion of 90 correct responses in 100 consecutive trials. At this stage in the experiment testing procedures for the Retention and Learning Groups were differentiated.

On the day following completion of the initial discrimination the Retention Group started training on the *roughness series*. Daily sessions of 25 trials were given. The grade 280 paper (smooth) was always the unrewarded comparison stimulus, with grades 36, 50, 80, 120, and 180 sandpaper as test stimuli. Two successive days of testing were given on each test stimulus, starting with the roughest paper (grade 36) and continuing in order of increasing difficulty. The monkeys were then given a rest period and the roughness series was presented again at intervals of three weeks. On these tests only 25 trials were given with grade 36 and with grade 50 sandpaper. After completion of the third roughness series the subjects in this group had the alumina cream implanted. Six additional roughness series were given, with three weeks between successive series.

The subjects in the Learning Group, after they had reached criterion on the initial discrimination, were given 50-trial retention tests on this discrimination at intervals of three weeks. Upon completion of the first retention test alumina cream was implanted over posterior parietal cortex. Retention tests were continued at intervals of three weeks until a monkey's EEG revealed clear-cut patterns of paroxysmal spike discharges, recorded from one or both posterior parietal electrodes. The subject then began testing on the roughness series. Retention tests on the roughness series, following the procedure for the Retention Group, were continued at intervals of three weeks for a total of five series. On the four days immediately following the fifth series 25 trials daily were given additionally with grade 180 sandpaper as the test stimulus.

Additional testing. After completion of testing with the grade 180 sandpaper the four rhesus monkeys were tested for 50 trials each with two blocks of grade 280 sandpaper in order to check the possibility that correct responses had been made to extraneous cues.

The rhesus monkeys were then tested on the visually guided delayed alternation task (the cynomolgus monkeys were not tested on this task because they had been previously trained in the same apparatus on a different problem, Wilson, 7). On the alternation task the first response on each testing day was rewarded. The peanut was then placed in the cup opposite to the one that had been rewarded on the previous trial. When an incorrect response was made, the cup remained baited until it was opened by the subject. An opaque screen was raised to separate the subject from the cues during the intervals between successive responses. Fifty trials (rewarded responses) per day were given until the subject met the 90% criterion in 100 trials. A monkey was considered to have failed if criterion was not met within 1,000 trials.

All ten subjects were finally given 50 trials per day on discriminating a painted cross (rewarded) from the painted outline of a square until the criterion of 90 correct responses in 100 trials was attained.

RESULTS

Anatomy

Fig. 1 illustrates placement of the implanted disks in two brains. Location of disks indicated in Fig. 1B is representative of the majority of subjects, and only occasionally were disks placed over medial cortex as seen by Fig. 1A. Gross and microscopic examination of the brains revealed depression of cortex underneath the disks and

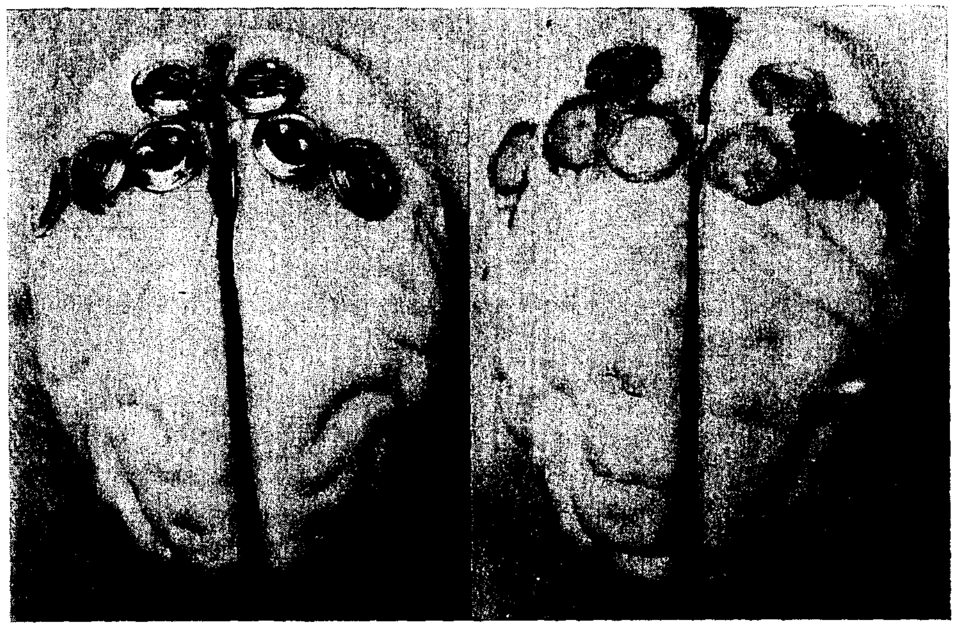

Fig. 1. Photographs of two brains after perfusion, showing location of alumina cream implantation. A: disks placed on brain; B: after removal of disks.

growth of connective tissue. The appearance of cortex underneath the implants is in agreement with the description and illustrations presented by Chow and Obrist (*2*). Although the disks caused scarring and some damage to cortical structures, the magnitude of neuronal destruction was considerably less than that seen after ablation of posterior parietal cortex. Examination of thalamus revealed small zones of degeneration in the nuclei pulvinaris lateralis and lateralis posterior in some of the brains. However, thalamic degeneration was never as marked as that seen in brains after ablation of parietal cortex (Bates and Ettlinger, *1*).

Behavioral observations

During the early postoperative period the monkeys exhibited behavioral signs similar to those reported by Bates and Ettlinger (*1*) for monkeys after bilateral ablation of posterior parietal cortex. The subjects sat almost immobile in the cage in a hunched position, frequently with their feet against the wire mesh of the cage at head level. Their reactions to an observer were slow and characterized by a gradual withdrawal to the rear of the cages. They took only a few pieces of food. These symptoms did not persist as long in the implanted animals as in ablated monkeys, and generally after the fourth postoperative day our subjects exhibited normal patterns of activity and ate the regular diet. During the first postoperative testing, which occurred within two weeks after implantation of alumina cream, all subjects performed efficiently in the apparatus and none showed marked signs of ataxia.

The operated subjects were observed in the home and testing cages for overt signs of epileptoid seizures. No behavioral seizure signs were seen throughout the period of somesthetic testing in two subjects in the Learning Group and in three monkeys in the Retention Group. In the other animals frequent episodes of tremor in one leg were noted, beginning eight weeks after operation. These tremor episodes persisted for long periods (sometimes intermittently for several hours), but usually did not involve other extremities. In two of the subjects more extensive convulsive activity was observed a few times toward the end of somesthetic testing. Seizure episodes were observed in five monkeys throughout the testing program and in one other subject (No. 589) epileptoid symptoms, including a few clonic convulsions, were first seen during testing on the alternation task.

During the alternation testing the rhesus subjects were observed in the testing situation for signs of abnormal motor behavior. Subject No. 585 exhibited patterns of hypomobility and ataxia — it sat quietly in the testing cage for relatively long periods of time, had some difficulty in opening the covers on the bait boxes, and was poorly coordinated when jumping into the testing cage. Another subject (No. 600) exhibited hyperactivity by frequently walking in circles in the cage, but it did not reveal ataxic symptoms. The two other rhesus subjects showed essentially normal behavioral patterns in spontaneous activity — reaching, jumping, and manipulation of the apparatus — except that one monkey had some difficulty in efficiently picking up the peanut.

Electroencephalography

Focal paroxysmal discharges from parietal cortex were seen in the EEGs of all subjects. The discharges were first recorded between 8 and 12 weeks after implantation of the alumina cream. In four subjects (in which no behavioral seizure signs had been observed) spike discharges were first recorded only after activation with graded dosages of metrazol (approximately 10 mg/kg bodyweight). Paroxysmal activity was seen in the subsequent recordings from all of the subjects without metrazol activation.

During preoperative and postoperative recordings spindle-type discharges, indicative of normal drowsiness, were frequently obtained. As seen in Fig. 2 (A and B), these discharges were recorded symmetrically from electrodes placed over left and right parietal cortex and from the vertex. By contrast, the epileptoid paroxysmal discharges were generally recorded independently from left or right parietal electrodes. The tracing shown in Fig. 2 (C and D), taken five months after implantation, shows a focus of spike discharges from right parietal cortex with essentially normal EEG patterns from the opposite hemisphere. In all subjects independent parietal foci from the two hemispheres could be distinguished, with discharging patterns sometimes appearing simultaneously and at other times independently.

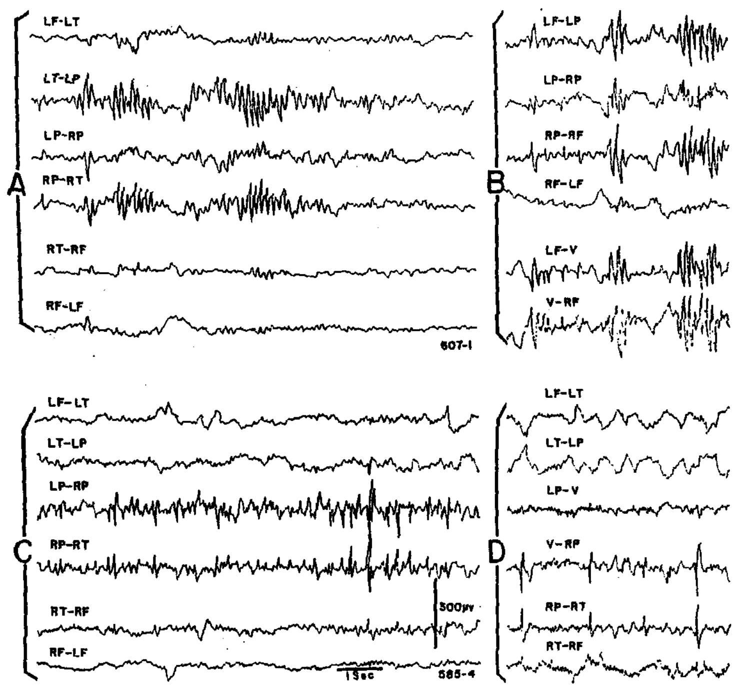

Fig. 2. Samples of EEG from two monkeys. A and B are traces from one recording taken preoperatively C and D traces from a recording taken five months after implantation of alumina cream. Bipolar scalp recordings between locations indicated: L: left, R: right hemisphere; F: frontal; T: temporal; P: posterior parietal and V: vertex. Calibrations as indicated.

Somesthetic learning

Since no monkey in the Retention Group exhibited signs of epileptoid discharges during the first five somesthetic series, this group may be considered as normal for comparisons with the epileptoid subjects in the Learning Group.

When tested on the first roughness series, all subjects in both experimental groups gave 90% or more correct responses on discriminations with grades 36 and 50 sandpaper as the test stimuli. However, on discriminations with grade 80 and the finer papers higher scores of correct responses were obtained by the Retention than by the Learning Group. Fig. 3 shows the means of correct responses for the two groups on discriminations with grades 80 and 180 papers, respectively, as the test stimuli. On the easier of these discriminations (80 *vs.* 280) the epileptoid monkeys in the Learning Group were initially somewhat inferior to the unoperated monkeys, but the group's scores improved rapidly and after some training a level above 90% correct responses was reached. Similar results were obtained on discriminations with grade 120 paper on which the Learning Group attained the response level of the normal monkeys after the third series, with both groups responding near 90% correct during the subsequent test series. On the most difficult discrimination (180 *vs.* 280),

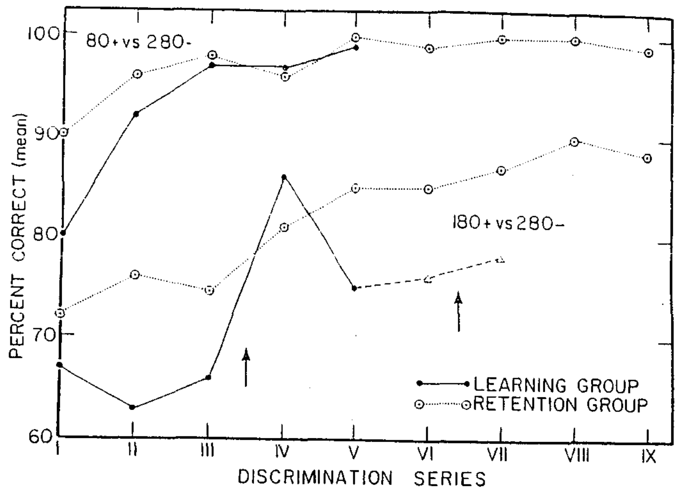

Fig. 3. Correct responses (group means) for Learning Group and Retention Group on successive roughness discrimination series of 50 trials each. The comparison stimulus was always grade 280 sandpaper; the test stimuli (rewarded) were grade 80 paper for the upper pair of curves, grade 180 for the lower pair. The triangles represent scores obtained on two additional testing days with 180 paper. First arrow indicates implantation of alumina cream; second arrow, the onset of paroxysmal EEG discharges, in the Retention Group.

however, scores for the epileptoid monkeys remained generally below those of the normal monkeys. During the fourth discrimination series three epileptoid subjects responded exceptionally well on all discriminations, but their scores dropped considerably on the following test series.

The four monkeys which were eventually tested on two blocks of grade 280 paper obtained a mean score of 52% correct responses, indicating that the subjects had not responded to extraneous cues during the preceding somesthetic discriminations.

Discrimination thresholds

Thresholds on the roughness discriminations were obtained for every subject by plotting its scores of correct responses as a function of the logarithm of roughness of the test stimulus (grains/inch) for each roughness series and determining the 75% intersects. Group means of thresholds for each series were then computed for the Retention Group and for two subgroups in the Learning Group. The data for the latter group was arranged in two subgroupings, because the results obtained for the three subjects with behavioral seizure signs (*Subgroup A, seizure*) were different from those for the two monkeys which exhibited no seizure signs (*Subgroup B, non-seizure*). Mean thresholds of roughness discrimination for these three groups are shown in Fig. 4.

As seen by this figure, both epileptoid subgroups had lower thresholds than the normal monkeys during the first two discrimination series. On the third series the threshold

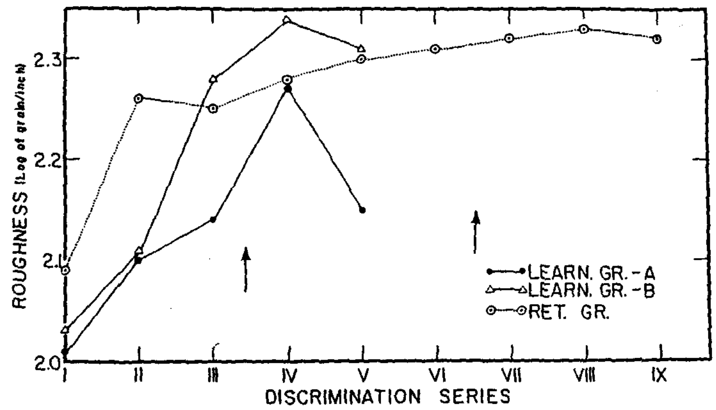

Fig. 4. Roughness Thresholds (logarithm of roughness for 75% correct responses) on successive discrimination series by two groups of epileptoid monkeys (*Group* A: *those with overt seizure signs*; Group B: those without overt *seizure signs*) and by the Retention Group. First arrow indicates implantation of alumina cream; second arrow, the onset of paroxysmal EEG discharges, in the Retention Group.

for Subgroup B rose rapidly to the threshold level of the normal monkeys, and this threshold was maintained during subsequent testing. Thresholds for the Subgroup A increased after the second series, but remained below the thresholds for the non-seizure subgroup during the final three series. The threshold curve for the monkeys in the Retention Group increased as a function of continued testing before and after implantation of alumina cream.

Discrimination thresholds for the total Learning Group and the Retention Group were evaluated statistically by a two-way Analysis of Variance for the first five discrimination series. As seen by Table I, significant *F*-ratios were obtained for differences among successive discrimination series and for differences between the

TABLE I

ANALYSIS OF VARIANCE FOR THRESHOLD VALUES ON ROUGHNESS DISCRIMINATIONS

Source of variation	*d.f.*	*Estim. Variance*	*F*	*P*
Groups	1	0.0578	6.34	$<.05$
Series	4	0.0815	8.95	$<.001$
Interaction	4	0.0095	1.04	N.S.
Within sets	40	0.0091	—	—

two experimental groups; whereas the variance of interaction between series and groups was not significant. This finding would indicate that the epileptoid animals started at lower discrimination thresholds than the controls, but improved threshold values during subsequent training at approximately the *same rates* as did the normal monkeys.

Somesthetic retention

As seen by Figs. 3 and 4, the onset of epileptogenic discharges in the Retention Group (indicated by the second arrow) did not interfere with the monkeys' learned discrimination ability. On the most difficult discrimination with grade 180 paper as the test stimulus three of the five subjects attained 90% correct responses during the last 100 trials (Series VIII and IX).

When the Retention Group was divided into subgroups of monkeys exhibiting seizure signs (two subjects) and those without behavioral seizure symptoms (three subjects), slight but consistent differences in scores were obtained. On the fifth and sixth series both subgroups obtained identical discrimination thresholds of 2.30 and 2.32, respectively. However, on the first series after the onset of epileptogenic discharges (Series VII), the threshold for the seizure subgroup declined to 2.28. On the final two series it reached 2.30. Thresholds for the non-seizure subgroup increased slightly after Series VI, reaching a final level of 2.34 during the last three series.

Delayed alternation

When tested on the delayed alternation task, two subjects attained the 90% criterion after 340 (No. 585) and 740 (No. 589) trials, whereas the two others failed to attain criterion performance within 1,000 trials. These latter two monkeys obtained maximum scores of 87 correct responses in 100 trials after 450 and 600 trials, respectively, but their performance then declined to 78% and 76% correct during the final 100 trials.

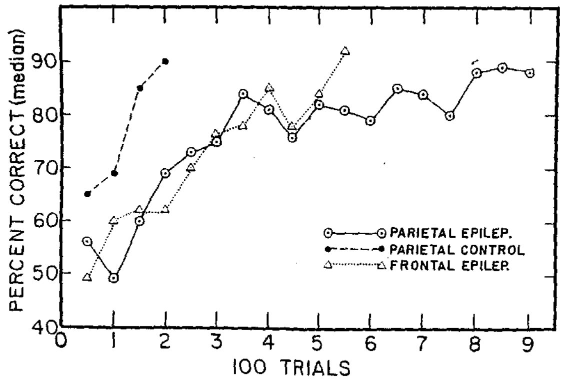

Fig. 5. Learning curves on alternation task for groups of monkeys with parietal cortical implants (parietal epileptic), with frontal cortical implants (frontal epileptic), and normals (parietal control). Group medians of percent correct responses for successive blocks of 50 trials.

The learning scores of the four epileptoid subjects may be compared with those of normal rhesus monkeys (used in another investigation), which had first been trained on the roughness discrimination of grades 80 *vs.* 180 sandpaper. On the alternation task these four monkeys reached the 90% criterion after 10, 100, 180 and 260 trials, respectively. The deficit of the present experimental subjects may also be evaluated by the learning curves shown in Fig. 5. This figure includes the learning curve for the group of three monkeys with epileptogenic discharges from frontal cortex tested in a previous investigation (Stamm and Pribram, *4*), which attained the 90% criterion after 420, 490, and 510 trials. Both groups of epileptoid monkeys improved on the alternation task at approximately equal rates (considerably below the rates obtained for the unoperated group) until they responded at approximately 85% correct. The frontally epileptoid group then continued to improve until the learning criterion was reached, whereas the parietally epileptoid group showed only little further learning during several hundred trials of continued testing. Thus, on the delayed alternation task epileptogenic discharges from posterior parietal cortex appeared to interfere with learning rates more markedly than did discharges from frontal cortex.

Visual discriminations

On the visual pattern discrimination the learning criterion was attained by the six cynomolgus monkeys after 200 to 520 learning trials (median 360) and by the rhesus monkeys after 350 to 550 (median 405) trials. Median trials to criterion for the total group of epileptoid subjects was 400 trials. In a previous investigation (Stamm and Pribram, *4*) normal cynomolgus monkeys, which had first learned the alternation task, required 360 to 530 trials (median 380) on the visual discrimination problem. Consequently, the epileptoid parietal monkeys showed *no* marked deficit in learning of the visual discrimination task. When the experimental subjects were separated into subgroups of those with behavioral signs of epileptoid seizures and those without overt signs, no consistent differences in learning scores were obtained. Median scores were 355 trials for the former subgroup and 410 trials for the latter, with considerable overlap in scores between the two.

DISCUSSION

It was hypothesized that epileptogenic lesions in posterior parietal cortex had differential effects on retention and on acquisition of somatosensory tasks. In evaluating the findings of the present investigation, this hypothesis will be further examined.

Effects on retention

After the onset of epileptogenic discharges the subjects in the Retention Group showed no appreciable decline in scores of correct performance on the roughness discriminations. This group actually improved somewhat during continued training and its final scores on the most difficult discrimination, with grade 180 as the test stimulus (Fig. 3), were higher than those obtained by unoperated monkeys in another investigation (Wilson *et al.*, *8*). It has also been reported (Chow and Obrist, *2*) that epileptogenic implantations over posterior parietal cortex did not affect retention scores on visual discriminations. These findings, taken together with those from investigations with epileptogenic foci in frontal and inferotemporal cortex (Stamm and Pribram, *4*, *5*), support the conclusion that memory for previously learned tasks remains highly resistant to epileptoid disturbances from isocortical structures.

Effects on learning

The epileptoid monkeys were deficient in the acquisition of the roughness discriminations, as seen by the learning curves (Figs. 3, 4) and the statistical analysis of thresholds. However, analysis of the data showed that the deficit could not be simply attributed to retarded rates of learning, as was found in the experiments with frontal and with inferotemporal implants (Stamm and Pribram, *4*, *5*). In the present experiment the epileptoid monkeys responded more poorly than did the normal animals during the initial testing on the roughness discriminations and throughout training on the alternation task. In addition, those subjects which also exhibited epileptoid seizure signs could not attain the final discrimination thresholds obtained by the other groups (Fig. 4).

Further differences between epileptoid and normal subjects are seen by their patterns of responses to stimuli which could not be readily discriminated. During testing on the first roughness series all subjects responded above the 90% criterion on the easier discriminations. Among the group of normal monkeys, scores below this criterion were first obtained with the grade 120 paper as test stimulus by four subjects and on the grade 80 paper by one subject. For the 50 trials with the 120 paper for the four monkeys and the 80 paper for the fifth, this group obtained a mean of 71% correct responses, with means of 66% for the first 10 trials and 73% for the following 40 trials. Four of the epileptoid subjects in the Learning Group first failed the 90% criterion with grade 80 as the test stimulus, and the fifth monkey failed with the grade 120 paper. The mean group score for the 50 trials on these discriminations was 74% correct, which is similar in magnitude to the score for the normal group. However, every epileptoid subject responded at a higher level during the first 10 trials than it did during the following 40 trials, with mean scores of 86% and 71% correct, respectively, for the 10 and 40 trial runs.

These data would suggest different interpretations of "failure" responses for the two groups. The normal monkeys were unable to discriminate the stimuli when they were first presented, but their scores improved with further training. By contrast, the epileptoid subjects at first responded only slightly below the 90% criterion which the normal monkeys had attained with these test stimuli, but they were unable to maintain correct performance during the succeeding trials. It appears therefore that the deficit manifested in performance by the epileptoid subjects is not due to their inability to discriminate adequately between the tactile stimuli, but is related to their difficulty in maintaining correct performance during prolonged testing. The difficulty in maintaining correct response patterns may also account for the fluctuations in threshold scores obtained by the seizure subgroup (Fig. 4) during the final discrimination series. The finding that thresholds for the non-seizure subgroup remained at the level obtained by the normal group for the last three discrimination series would indicate that epileptogenic cortical discharges as such do not result in persistent impairment on the discriminations. The behavioral signs seen in the *seizure* animals may be the more significant correlate of deficient discrimination performance, and it is plausible that spread of epileptogenic discharges from the focus of implantation interfered with the execution of the fine motor patterns required for testing of the stimuli.

These considerations, together with the finding of deficient performance on the alternation task, support the interpretation by Bates and Ettlinger (*1*) of "selective motor retardation" as the underlying impairment. However, alternative interpretations of the "parietal lobe deficit" should not be excluded. The behavioral difficulties of monkeys with ablated or with epileptogenic posterior parietal cortex may also be the consequence of excessive somatosensory habituation or of kinesthetic disturbance. Further experimentation is required in order to clarify the function of parietal cortex in the performance of complex tasks.

SUMMARY

Alumina cream was implanted bilaterally over posterior parietal cortex in monkeys. EEGs were recorded preoperatively and periodically after implantation. Two groups of five monkeys each were used, a *Retention Group* and a *Learning Group*. All monkeys were first trained in the dark on the initial discrimination between a very rough (rewarded) and a smooth (grade 280) sandpaper. The Retention Group was then given roughness discriminations on a graded series of test stimuli (rough to smooth), always with grade 280 paper as the comparison stimulus. This roughness series was repeated at intervals of three weeks for a total of nine series. Alumina cream was implanted after the third series. The Learning Group was tested on the initial discrimination every three weeks, and alumina cream was implanted after the first retention test. Retention tests were continued until the EEGs revealed focal paroxysmal spike discharges from parietal cortex. These monkeys were then trained on the roughness series, with intervals of three weeks between series, for a total of five series.

Four subjects were subsequently trained on a delayed alternation task, and all monkeys were finally tested on a visual pattern discrimination.

The following results were obtained: (1) Focal paroxysmal discharges were recorded in the EEGs of all subjects, starting 8 to 12 weeks after implantation and persisting throughout the lives of the monkeys. (2) On the first roughness series all subjects responded accurately on the easy discriminations, but on the difficult discriminations the Learning Group was inferior to the Retention Group (then normal monkeys). (3) On the subsequent roughness series the performance scores for all subjects improved. Discrimination thresholds (75% correct) were computed for the groups of monkeys for consecutive roughness series. The threshold curve for the Retention Group became asymptotic after the fourth series. In the Learning Group those

subjects which did not reveal behavioral seizure signs attained the same threshold values as the Retention Group, whereas the subjects which exhibited seizure symptoms continued to respond at poorer threshold levels than did the other monkeys. (4) Monkeys in the Retention Group showed no impairment in somesthetic discriminations *after* the onset of epileptogenic discharges. (5) On the alternation task the epileptoid subjects exhibited marked impairment, and two subjects were unable to attain criterion performance. (6) The visual discrimination was learned by all epileptoid subjects without appreciable deficit.

The present findings are in agreement with those from previous investigations which have shown that *memory* for learned tasks is not impaired by the onset of epileptogenic discharges. In the *acquisition* of new tasks, however, the epileptoid monkeys were deficient on several quantitative indices when compared to normals. In evaluating the behavioral data, the present results support the concept of "selective motor deficit" suggested by Bates and Ettlinger (*1*). However, alternate hypotheses concerning the function of parietal cortex must also be considered.

RÉSUMÉ

On a implanté de la crême d'alumine, bilatéralement, sur le cortex pariétal postérieur chez des singes. Des E.E.G.'s ont été enregistrés préopérativement et, périodiquement, après l'implantation. Il a été fait usage de deux groupes de cinq singes: un *Groupe de Rétention* et un *Groupe d'Etude*. Tous les singes ont d'abord été entraînés dans l'obscurité à la discrimination initiale entre un papier très rude (ré) et un papier lisse (degré 280). Le Groupe de Rétention a été soumis alors à des discriminations de rudesse par séries graduées de tests de stimulation (de rude à lisse), toujours selon le papier de 280 degrés en tant que stimulus de comparaison. On a réitéré cette série de rudesse à des intervalles de trois semaines, neuf séries au total. L'implantation de crême d'alumine s'est faite après la troisième série. Le Groupe d'Etude a été contrôlé toutes les trois semaines par des tests quant à la discrimination initiale, et la crême d'alumine implantée après le premier test de rétention. Les tests de rétention ont été poursuivis jusqu'à ce que les E.E.G.'s donnent un focus de décharges paroxysmales de pointes du cortex pariétal. Après cela, on a soumis ces singes aux séries de rudesse, pratiquées à des intervalles de trois semaines, cinq séries au total.

Quatre sujets ont été entraînés successivement selon un système d'alternance retardée, et tous les singes ont été finalement étudiés selon un type visuel de discrimination.

Les résultats suivants ont été obtenus: (1) Des décharges focales paroxysmales ont pu être enregistrées dans les E.E.G.'s de tous les sujets à partir de 8 à 12 semaines après l'implantation; elles ont persisté pendant toute la vie des singes. (2) Tous les sujets des premières séries de rudesse ont répondu exactement aux discriminations faciles mais, dans les discriminations difficiles, le Groupe d'Etude s'est montré inférieur au Groupe de Rétention (sujets normaux à ce moment). (3) Dans les séries successives de rudesse, le degré de prestation de tous les sujets s'est amélioré. Les seuils

de discrimination (corrects en 75%) ont été comptés pour le groupe de singes sur des séries consécutives de rudesse.

La courbe du seuil du Groupe de Rétention est devenue asymptomatique après la quatrième série. Dans le Groupe d'Etude, les sujets qui n'ont pas manifesté de signe de crise dans leur comportement ont atteint des valeurs de même seuil que celles du Groupe de Rétention, tandis que les sujets qui avaient manifesté des symptômes de crise ont continué à répondre à des niveaux de seuil plus bas que ceux des autres singes. (4) Les singes du Groupe de Rétention n'ont pas révélé d'endommagement au sens de discriminations somesthétiques après le début des décharges épileptogènes. (5) Dans la tâche d'alternance, les sujets épileptogènes ont montré un endommagement marqué et deux sujets ont été incapables d'arriver au critérium de l'action. (6) La discrimination visuelle a été apprise par tous les sujets épileptoïdes sans qu'elle ait manifesté de déficit appréciable.

Les constatations présentes s'accordent avec celles de recherches précédentes, lesquelles avaient révélé que la *mémoire* de la tâche apprise n'est pas endommagée par le début des décharges épileptogènes. En ce qui concerne *l'acquisition* de nouvelles tâches, toutefois, si on les compare à des animaux normaux, les singes épileptogènes sont déficients en plusieurs indices quantitatifs. L'évaluation des dates relatives au comportement révèlent que les présents résultats soutiennent le concept "selective motor deficit" suggestionné par Bates et Ettlinger (*1*). Toutefois, différentes hypothèses concernant la fonction du cortex pariétal sont à considérer.

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Epilepsia, 2 (1961) 229–242

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