THE VALUE OF ACTIVATION PROCEDURES IN THE DIAGNOSIS OF EPILEPSY WITH SPECIAL REFERENCE TO THE USE OF THE ELECTRO-ENCEPHALOGRAM.

BY

JOHN TORRIE HUTCHINSON (M.B.Ch.B.Glasgow, D.P.M.London.)

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

TABLE OF CONTENTS. page.

INTRODUCTION 3

FORCED HYDRATION 6

VOLUNTARY HYPERPNOEA 12

HYPOGLYCAEMIA 22

SLEEP 25

EPILEPTIFORM ABNORMALITIES produced by STIMULATION OF NERVOUS PATHWAYS 29

EPILEPTIC PHENOMENA produced by STIMULATION OF OPTIC PATHWAYS 33

METRAZOL 42

MISCELLANEOUS METHODS 67

CLINICAL INVESTIGATION 72

(1) A small group of patients with abnormal resting records who showed further abnormalities after provocative stimulation 74

(2) Epileptic patients without epileptiform EEG abnormalities, at rest, who responded in a positive way to the tests 86

(3) Epileptic patients without epileptiform EEG abnormalities, at rest, who made no response to the tests 149

(4) Non epileptic patients who responded in a positive way to the tests 177

(5) Non epileptic patients who made no response to the tests 223

SUMMARY OF INVESTIGATION 278

ANALYSIS OF TEST RESULTS 279

REFERENCES 287

INTRODUCTION.

When changes were first noted in taking electrical recordings from the scalp of an epileptic, the true significance of the findings was not appreciated. (Berger, 1931). Eventually, more accurate information was available, and a description of the electrical changes during a seizure was made by Gibbs, Gibbs and Lennox (i)(1937).

The problem now becomes apparent - the electroencephalogram (abbreviated to EEG subsequently), is only of value in diagnosis if it records seizure discharges. However, these, like the seizures, are transient, fleeting phenomena, and are not seen necessarily in the records of every epileptic patient. There are several studies to support this contention. Walter (1938) examined 214 patients and considered that 91 showed interseizure abnormality. He wrote that 50 per cent. of patients under the age of 40 showed some abnormality, but few over 40 showed any abnormality. Finley and Lines (1942) noted that 14 per cent. of 626 epileptics had normal records and that 86 per cent. were borderline. Gibbs, Gibbs and Lennox (i)(1943) found the EEG to be of value in diagnosis in 38 per cent. of 1,260 epileptic patients, and to be supporting /

supporting evidence in a further 20 per cent. Therefore, one may make a conservative statement and note that no abnormality was found in 42 per cent. of epileptic patients.

This problem of diagnosis in epilepsy was one which exercised the minds of the medical writers of the classical period. Overbreathing was mentioned indirectly by Galen (1) in the advice he gave on exercise which, he wrote, might make a patient epileptic. Again, Galen (2) thought that the nomadic habit played a part in the production of fits in certain adolescents. He believed that these might be caused by sleeping on the ground, or by exposure to showers of rain. He listed, also, a variety of other causes of fits (3). These included frost, violent heat, strong winds, strenuous baths, repulsive food, whirling wheels, lightning, thunder, sleeplessness, indigestion, distress, anger, weariness and similar factors of which the chief characteristic was that they stirred up and troubled the body violently, reminding it of the disease and producing a paroxysm.

Alexander of Tralles described the value of burning goat's horn under the nose of a suspected epileptic. He mentioned, also, the burning of precious stones such as agate and jade, with a similar effect, and believed that the odour /

odour of myrrh would be equally efficacious. Alexander of Tralles also considered that fits could be precipitated by wrapping an epileptic in a goatskin and plunging him into the sea. If he sank, he was an epileptic.

Hippocrates wrote extensively on this subject. He thought wet weather played a part in the production of seizures (1), and considered that oedema was an unfavourable finding in an epileptic patient (2). He wrote that the risk of having a fit was greatest in the spring, when the sun might shine suddenly on a susceptible person (3). He cited, also, the effect of fear in producing attacks in children, and considered that the breathing difficulties produced by fear might play a part. He found an excessive amount of water in the brains of epileptic goats, and considered that this was present in the brains of epileptic men. (4).

Aristotle noted the part sleep played in the production of seizures, and considered that these were more frequent in sleep than in waking.

A method of predicting epilepsy in new-born infants by bathing them in wine was described by Plutarch.

Apuleius, in his Apologia, noted that seizures could be produced by the spinning of a potter's wheel before the eyes of a suspected epileptic. He thought that the giddiness thus induced helped to provoke a fit. He wrote : "The potter is more effective than the magician for casting epileptics into convulsions."

In /

In the present century, activation procedures have continued to prove themselves of value, and it is proposed to describe briefly the history, application and possible rationale of the following methods: Forced hydration, voluntary hyperpnoea, hypoglycaemia, sleep, stimulation of sensory pathways (including the optic tracts), metrazol and finally, the use of each of a small group of miscellaneous drugs.

I.

FORCED HYDRATION

I should like to draw attention again to the observations of the classical authors described in the introduction. Oedema of the brain and exposure to water were described by many of them. About thirty years ago, Weir, Larson and Rowntree (1922) noted that subcutaneous injections of pituitary extract inhibited diuresis in patients suffering from diabetes insipidus, and produced a state of water intoxication in one normal control subject to whom water was given in large amounts. Some dogs, treated similarly, experienced convulsions. This observation was not utilised clinically until McQuarrie and Peeler (1931) demonstrated that grand mal fits could be induced in epileptic children (but not in non-epileptic children) by pituitary injections combined with a forced fluid intake. This discovery /

discovery was a sequel to an earlier observation by McQuarrie (1929) that epileptics tended to retain water during the acute phase of the disease, and that seizures could be prevented by restriction of fluid intake. Jacobsen (1934) used this method as a diagnostic tool in a study of 40 patients. He thought it was of some value, but that it was difficult to carry out properly because in some patients no positive fluid balance could be produced, and in others nausea became so pronounced that the test had to be abandoned. Gibson (1937) combined the water-pitressin test, as it was now known, with voluntary hyperpnoea and produced fits in 50 per cent. of 11 epileptic patients. Janz (1937) found that the water-pitressin test alone gave a positive result, by the production of seizures, in 35.8% of a group of epileptic patients, whereas metrazol was of diagnostic value in 54.6%, and voluntary hyperpnoea in only 10%. Blyth (1943) stated that the water-pitressin test would assist accurate diagnosis in 86.6% of epileptic patients by giving a positive response. However, Garland, Dick and Whitty (1943) were more conservative in their outlook and considered that the test was of diagnostic value in 39% of proven epileptics, and they found also 38% of positive results in a group of borderline epileptic patients.

In the same year, this knowledge was applied to a case of forensic interest by Hill, Sargant and Heppenstall (1943). A young man had murdered his mother after consuming five pints of beer. The physiological state of the patient at /

at the time of the crime was reproduced in the laboratory, and it was noted that EEG abnormalities appeared in association with impairment of consciousness after the consumption of five pints of beer.

Blier and Kedlich (1947) used the water-pitressin test combined with EEG examination to differentiate between a group of patients suffering from epileptic fits and a group suffering from syncopal attacks. No gross EEG changes occurred in the latter group, but, in the epileptic group, very fast wave forms associated with petit mal and psychomotor activity appeared in 25% of the patients examined. The remainder of the group showed less specific changes, and one of the two patients who had normal records throughout the test, had two major seizures five hours later. The authors noted unpleasant side effects such as pallor, headache, nausea and vomiting. In the same year, Cohn, Kolb and Mulder (1947) described a somewhat similar investigation. They were not impressed by the method since they considered that water intoxication led to EEG changes in the majority of individuals and that these changes were not necessarily epileptic in nature. It was noted, also, that several patients who habitually experienced grand mal seizures, showed no abnormality during the test.

Since these papers were written, the test appears to have dropped out of use as a diagnostic aid, possibly having been supplanted by the newer methods of provocation which will be /

be described later. But, doubtful as its value was, there was no dubiety about the fact that the combination of raised fluid intake and pituitary injections could bring about seizures. The mechanism of this phenomenon is worthy of study, since it may well have some bearing on the physiological background of other methods of inducing epileptic fits.

It seems likely that the epileptic manifestations appear in response to changes in electrolyte concentration, and are not caused simply by a rise in cerebro - spinal - fluid pressure. There is no doubt that injections of posterior pituitary extract cause a diminished urinary flow and increased re-absorption from the renal tubules. This is attributed by Samson Wright (1940) to stimulation of the epithelium of the renal tubules to absorb more water. McQuarrie and Peeler in the paper quoted above found that the administration of NaCl prevented the occurrence of fits in epileptic children who were susceptible to the water-pitressin test, and they consider-:ed that the mechanism for controlling the semi-permeability of the brain cell was defective in the epileptic.

There seemed to be no doubt that the use of the water-pitressin test led to some dilution of blood serum as was indicated by a lowering of the osmotic pressure of the blood. This was ascertained by measuring the Freezing Point as was shown by Fremont Smith and his co-workers (1931), who deduced that the fall in osmotic pressure in blood serum was reflected /

reflected by a similar fall in the C.S.F. Clegg and Thorpe (1935) demonstrated that a fall in blood serum osmotic pressure coincided with the onset of a fit in a group of epileptic patients exposed to the water-pitressin test.

Williams (1939) studied a group of patients with raised intra-cranial pressure due to supratentorial tumours. These patients showed EEG abnormalities which could be abolished by intravenous infusions of 30% NaCl. When he raised the C.S.F. pressure in two normal subjects to 500 mm. (H_2O) by the application of a sphygmomanometer cuff to the neck, no EEG changes occurred. No abnormalities were seen also when the water-pitressin test was used to raise the C.S.F. pressure to 190 mm. (H_2O) in one normal subject, and 280 mm. (H_2O) in another. Williams believed that the EEG changes were due to an intra-cellular oedema, and he believed that the water-pitressin test alone produced an extra-cellular oedema. This point of view would seem to fit in with that expressed earlier by McQuarrie and Peeler, i.e., that the semi-permeability of the brain cell was defective in the epileptic. These views received further confirmation by the experiments on rats of Swinyard, Toman and Goodman (1946), when it was shown that intra-cellular hydration accompanied by depletion of extra-cellular electrolytes lowered the threshold to electrically or metrazol induced seizures by 56%. A paper by Gellhorn and Ballin (1946) demonstrated that different degrees of water intoxication /

intoxication in rats could produce different forms of EEG abnormalities, i.e., high voltage slow waves at one level, and spikes, spike and wave at other levels in the same animal. They postulated that petit mal, grand mal and psychomotor epilepsy were thus due to the same basic disturbance of brain function.

Conclusion.

It seems likely that the production of EEG abnormalities of epileptiform type can be brought about by cellular hydration and a fall in extra-cellular electrolytes. It is difficult to reproduce this state of affairs in normal subjects, but it can occur in experimental animals and also in certain epileptic patients in whom defective permeability of the cell membrane has been postulated. The work of Gellhorn and Ballin (quoted above) might lead to the supposition that different forms of epilepsy might be due to different degrees of cell membrane permeability.

The combination of pitressin injections and forced water intake has been used in the diagnosis of epilepsy, but it has proved to be uncertain in its action, and has had unpleasant side-effects. Little has been written about it in recent years.

II.

VOLUNTARY HYPERPNOEA.

This method (subsequently described as over-breathing) has been of value in the diagnosis of epilepsy for many years. It was used first by Rosett (1924) who was interested in the various forms of rigidity which voluntary overbreathing could produce. In that year, Foerster (1924) described epileptic fits which had been facilitated by voluntary overbreathing. This was achieved in 55% of the patients studied. Another clinical investigation by Fog and Schmidt (1931) showed that overbreathing produced epileptic phenomena in seven out of twenty patients. Eventually, interest was stimulated in the physiological changes involved in overbreathing. Wolff and Lennox (1930) described experiments on cats in which the pial vessels were exposed and observed. It was noted that an increase in the diameters of the vessels could be produced by increased CO_2 concentration in the blood, decreased O_2 concentration and acidosis. Alkalosis, increased O_2 concentration and decreased CO_2 concentration produced a moderate decrease in the diameters of these vessels. Kinnier Wilson (1935) wrote categorically that acidosis tended to inhibit seizures and alkalosis to cause them. The blood became alkaline by forced voluntary respirations. Overbreathing was also considered to cause fits by lowering the oxygen tension in the tissues. Gibbs, Lennox and Gibbs (1936) described

the /

the EEG changes in petit mal epilepsy, notably the classical 3 per sec. wave and spike discharge. They remarked that overbreathing facilitated the appearance of this phenomenon.

A further step in the synthesis of this new knowledge was made by Dusser de Barenne, McCulloch and Nims (1937). They studied the p.H. changes in the cortex of curarised animals, and noted that hyperventilation produced by artificial respiration caused a marked alkaline shift, whereas hypoventilation resulted in an acid shift. States of increased alkalinity and acidity were achieved also by intravenous injections of sodium bicarbonate and dilute acids. It was found that an increased alkalinity of the cortex was associated with an increase in electrical activity, and increased acidity caused a decrease in activity.

Lennox, Gibbs and Gibbs (1938) noted that overbreathing caused a diminution of the blood flow through the brain, and they concluded that the variations in cerebral blood flow were closely related to changes in alveolar carbon dioxide levels. A clinical investigation by Cobb, Sargant and Schwab (1939) showed that in many epileptics suffering from petit mal, the seizures were preceded frequently by spontaneous overbreathing. This was done by recording simultaneously on the EEG and on the kymograph of a B.M.R. apparatus. Later, Gibbs, Lennox and Gibbs (1940) studied the CO_2 content of the blood in patients suffering from different forms of epilepsy. They noted that in petit mal epilepsy /

epilepsy the CO_2 content of the blood was abnormally low, while in patients suffering from grand mal attacks, the CO_2 levels were abnormally high. A further study by Nims, Gibbs, Lennox, Gibbs and Williams (1940) was carried out on patients suffering from petit mal attacks, and on control subjects. The CO_2 concentration and pH. values of blood from the jugular vein were studied. It was remarked that in the patient subject to petit mal attacks, overbreathing produced a pronounced drop in the CO_2 content of the internal jugular vein, and this drop was maintained for a longer period than in the control subject. The changes in the acid base balance were also greater in the patient suffering from petit mal epilepsy than in the control subject. In a later paper, Gibbs, Gibbs, Lennox and Nims (1942) wrote categorically that the slow waves seen on the EEG during overbreathing were caused by a drop in the cerebral CO_2 concentration, and not by anoxia secondary to cerebral vasoconstriction. The constriction of cerebral arterioles which followed a decrease of CO_2 in arterial blood served to protect the brain. In petit mal epilepsy, the cerebral vasoconstriction response to low CO_2 tension was defective.

Meanwhile, other investigations on EEG aspects of overbreathing had been proceeding. Brill and Seidemann (1941) had shown that there was a marked tendency towards the development of a dysrhythmia during overbreathing in younger children. /

children. This tendency diminished with advancing age. Davis and Wallace (1941) described a standard method of using the overbreathing test. They suggested that the patient should breathe in and out fifteen times per minute for three minutes. They considered that an exchange of approximately 45 litres per minute took place, and they found an increase in the pH. of the blood of 0.20 associated with a fall in CO_2 tension of 18 mm. Hg. They stated their belief that vasoconstriction was responsible for slow waves in the EEG. In a further paper, Davis and Wallace (1942) suggested that overbreathing caused the appearance of slow activity by inducing cerebral vasoconstriction which in turn caused a diminution of O_2 and dextrose to the cerebral cortex.

Some further clinical studies appeared during this period. Hill and Watterson (1942) used the overbreathing test in a study of psychopaths, and noted that 65% of a group of aggressive psychopaths showed a dysrhythmia as did 69% of a group of 50 epileptics. Heppenstall and Hill (1943) utilised the procedure in a study of post-traumatic syndromes. They remarked on the fact that EEG abnormalities and an abnormal overbreathing response occurred with a significantly greater frequency in patients who sustained head injuries before the age of twenty. The time since the injury did not appear to influence the result. The relationship between the age of the patient and the nature of the response to overbreathing was /

was remarked upon by Gibbs, Gibbs and Lennox (1943)(ii). They examined 2,281 normal subjects and 1,107 epileptic patients. A standard test of 100 breaths was used. A greater response was found in the epileptic patients. It was noted that generally the incidence of a good response fell up to age 35. After that age, the decline was negligible. By a good response was meant the appearance of EEG abnormalities.

Some studies were done at this time on the relationship between the blood sugar level and the EEG changes on overbreathing. Brazier, Finesinger and Schwab (1944) showed that with a blood glucose level of 130 mgm. per cent. no normal subjects showed slow activity within the delta range, (i.e., 1 to 3½ cycles per second) during the second minute of overbreathing and only 7 % of normals at non-fasting levels of blood sugar. After three minutes of overbreathing, 11% of normal subjects showed slow waves in relation to a blood glucose level of 130 mgm. per cent. and 38 per cent. at non-fasting blood sugar levels. Heppenstall (1944) studied the effects of raising the blood sugar level in a series of neurotic and epileptic patients to whom the overbreathing test had been applied. It was discovered that the EEG. abnormalities of the neurotic patients could be obliterated by raising the blood glucose level to above 130 mgm. per cent. However, raising the blood glucose level proved ineffective in the epileptic patients, and it was noted that these patients whose resting records were most abnormal tended to have abnormalities /

abnormalities persisting on overbreathing after the blood glucose level had been raised to above 130 mgm. per cent.

About this time, Darrow and his collaborators began a series of experiments which cast new light on the physiological mechanisms underlying the slow wave response on overbreathing. Darrow and Puthman (1943) described the effect overbreathing had in lowering the blood pressure. It was observed that if the heart rate increased during this fall in blood pressure, slow waves appeared in the EEG. This increase in heart rate was not accompanied by palmar sweating or a decrease in the downwards trend of the blood pressure. Therefore, it was postulated that the increased heart rate was due to a diminution in parasympathetic activity. In a later paper, the same authors (1944) noted that during a one-minute period of overbreathing the changes in the heart rate were antecedent to or simultaneous with the appearance of slow waves in the EEG. This phenomenon suggested that a vagal mechanism was responsible for the EEG changes.

Darrow, McCulloch, Green, Davis and Carol (1944) made some further studies on cats. The parasympathetic pathways over the facial nerve, geniculate ganglion and greater superficial petrosal nerve were interrupted by nerve section. Two minutes of overbreathing had no effect before nerve section, but after this operation on one or both sides, slow waves appeared in the EEG. Stimulation of central nerve endings /

endings abolished these changes. Physostigmine injected intravenously reduced the degree of slow wave abnormality and atropine increased it. The potentials recorded from the petrosal nerves were in part similar to those known to occur during autonomic regulation by the carotid sinus. The chief conclusion of these investigations was that the presence of a parasympathetic cholinergic mechanism which counteracted the effects of hypocapnia on the cerebral blood vessels seemed to be indicated. A subsequent paper by Barrow, Green, Davis and Garol (1944)(i) described in detail the investigation mentioned in the preceding paper. It was considered then that the alkalinity produced by overbreathing hastened the destruction of acetylcholine. Barrow, Green, Davis and Garol (1944) (ii), investigated this concept. They examined cats to which physostigmine had been given to prevent destruction of acetyl-choline. It was noted that slow waves failed to appear in overbreathing after section of the facial nerve.

Since then, some further papers on overbreathing have appeared. Engel, Ferris, Stevens, Logan and Webb (1946) demonstrated that a reduction in the level of consciousness was facilitated by a low blood sugar level, low oxygen tension in the inspired air and by the test being carried out with the patient sitting upright. They carried out estimations of the oxygen and carbon-dioxide tensions in the blood of the internal jugular vein. The glucose concentration and pH. were measured also, but no correlation could be found between changes in these factors /

factors and changes in the EEG. It was noted, further, that if slow waves did not appear in the EEG. within three minutes of commencing overbreathing, they were unlikely to appear.

Himwich, Hamburger, Maresca and Himwich (1946) did some estimations of the oxygen tension in the right and left internal jugular veins during overbreathing. They showed that there is a wide variation in levels of oxygen concentration between the two veins. They stated their belief that the cortical component of the cerebral venous blood flow appears, usually preponderantly, in one of the two internal jugular veins, and it was considered that the portion of the brain with the higher metabolic rate is the cortex.

Engel, Ferris and Logan (1947), in a clinical study, noted that there was a close correlation between the degree of slowing of the EEG during overbreathing, and the degree of reduction in awareness. It was observed, also, that only petit mal attacks were provoked by overbreathing. Grand mal attacks were never induced in this way.

Vigouraux and Gastaut (1949) reviewed the EEG response to overbreathing in a large number of patients who were suspected of being epileptic. It was considered that spike and wave was the only abnormality which was diagnostic of epilepsy, and that it was a mistake to regard slow waves as necessarily epileptic phenomena.

Leroy /

Leroy and Verdeaux (1950) described a patient in whom an epileptic fit was followed by deep sleep lasting several days. The fit could be induced by overbreathing. EEG records taken both during overbreathing and sleep showed bilaterally synchronous slow waves at 3 cycles per second. These changes were accompanied by a low pulse rate. The authors concluded that the effect of overbreathing and of sleep was to produce a state of vagotonia.

Conclusions.

From these observations, it is evident that voluntary hyperpnœa produces a fall in alveolar CO_2 tension and a state of alkalosis, which favours the production of spike and wave activity associated with petit mal. In the normal person, slow activity only appears which is seen more readily in younger subjects and can be abolished by raising the blood sugar level. Raising the blood sugar level is ineffective in preventing the appearance of abnormalities in epileptic patients. The test is considered to be of clinical value only if spike and wave activity is seen. The mechanism of the response was considered by Gibbs and his co-workers to be that a drop in arterial CO_2 produced slow activity in association with a protective cerebral vaso-constriction. In petit mal epilepsy, the cerebral vasoconstriction response was /

was defective. But the later work of Barrow and others showed clearly that the appearance of slow waves was associated with parasympathetic underactivity and low acetylcholine levels in the brain.

There the matter rests at the moment. It is clear that the EEG changes seen may well be due to interference with the normal metabolism of oxygen and glucose in the brain, but whether this failure occurs within the cell, the cell membrane, at the blood brain barrier or elsewhere, is open to conjecture.

III.

HYPOGLYCAEMIA.

Mention has been made already, in the previous section on voluntary hyperpnoea, of the significance of hypoglycaemia in relation to the results of that test. It is intended in this chapter to present fresh information on the use of hypoglycaemia in the diagnosis of epilepsy.

The earliest description of the epileptogenic effect of hypoglycaemia in a human subject was given by Miller and Trescher (1927), who noted that a diabetic patient had epileptiform convulsions following the injection of insulin. However, insulin convulsions had been demonstrated earlier by Olmsted and Logan (1923) who injected insulin into decerebrate cats, but the mechanism of this response was doubtful. Zagami (1930) showed that insulin convulsions could not be produced in animals by the local application of insulin to the brain. Since then, many descriptions of hypoglycaemic convulsions produced by parenteral injection of insulin in animals have been given, notably by Hall (1938), Goodwin, Lloyd and Hall (1938), Leibel and Hall (1938), Moruzzi (1939) and Goodwin, Kerr and Lawson (1940). There exists no great controversy about these findings - in short, the effect of hypoglycaemia was to produce slow activity in the EEG record and the onset of a convulsion was associated with a drop in both the arterial and venous blood flows. A later paper by Gellhorn and Kessler (1942) showed that the EEG slow activity of /

of hypoglycaemia could be abolished by breathing pure O_2.

Many attempts have been made to use this knowledge in the diagnosis of epilepsy. Liskind and Bolton (1936) failed to produce convulsions by injecting subcutaneously between 10 and 60 units of insulin into each one of a group of epileptics, and they considered that it was less efficacious than forced hydration. An EEG. study of 34 epileptic patients during insulin hypoglycaemia was made by Gibbs, Gibbs and Lennox (1939). The patients received insulin injections subcutaneously at a dosage of from 60 to 100 units. They noted that hypoglycaemia was only effective in increasing the incidence of spike and wave (petit mal) epilepsy, but that it had no effect in producing the abnormalities of other forms of epilepsy. Normal subjects showed the appearance of high voltage slow activity at low blood sugar levels as had been demonstrated earlier by Hoagland, Rubin and Cameron (1937) in their study of schizophrenic patients having insulin coma therapy. A paper by Davis (1943) described the effect of insulin hypoglycaemia on normal subjects from which he concluded that insulin hypoglycaemia was more certain than voluntary hyperpnoea in revealing cerebral dysrhythmia.

Hertz and Wulff (1948) applied the test to a mixed group of 59 subjects (epileptics, neurotics and controls), and each person received 16 units of insulin. The only abnormality /

abnormality to appear was high voltage slow activity, which occurred in some members of all three groups. Several proven epileptics showed no abnormality whatsoever. The test was considered to be unsatisfactory, but one criticism of this conclusion is that the insulin dosage was rather small. Baisset, Bugnard, Grezes-Rueff, Grezes-Rueff and Planquer (1948) examined 50 epileptic patients who were given insulin on the basis of one unit per kilo body weight. In the average patient this would amount to a dosage of 60 units, and the method was effective by increasing tenfold the epileptiform abnormalities seen at rest. It is of interest that Hill (1948) has demonstrated that epileptiform abnormalities can be produced in certain schizophrenic patients by insulin hypoglycaemia.

Conclusions.

From the foregoing, it is evident that insulin hypoglycaemia will produce convulsions easily in animals, but that this result is rare in man. Indeed, the only form of epilepsy it has any effect on is that of the spike and wave variety, a property which is shared by it and voluntary hyperpnoea. The other property which it shares with the overbreathing test is the production of generalised high voltage slow activity. The reversal of these changes by the /

the breathing of pure O_2 suggests that the brain wave abnormalities are caused by interference with the normal metabolism of glucose taking place within the cell, the cell membrane or elsewhere in the brain.

IV.

S L E E P.

It is known that many epileptics have their seizures during sleep. Mention has been made already of Galen's observation that epilepsy could be induced by sleeping on the ground. This review of the literature on this subject is concerned with descriptions of the normal human EEG in sleep, the effect of sleep-inducing drugs on the human EEG, and the use of sleep as a diagnostic aid in epilepsy.

Gibbs, Davis and Lennox (1935) described the EEG in thirteen normal subjects during sleep, and four patients suffering from narcolepsy. In all cases, as the subjects became very drowsy, the predominant waves became slower and showed /

showed a greater amplitude. As the subject became sound asleep, the predominant electrical activity became still slower and smoother, showing a characteristic frequency of from three to five cycles per second, with a voltage of 60 micro-volts. Faster waves reappeared after a longer or a shorter interval.

Loomis, Harvey and Hobart (1936), in a comprehensive survey of EEG, described the following changes during sleep. As the patient fell asleep, the alpha activity became slower, but no dramatic change in brain-potentials occurred at the time of falling asleep as far as could be determined by the response to auditory stimulation. Fifteen minutes after falling asleep, the alpha activity disappeared, and was replaced by random waves at three to five cycles per second. A sound which did not awaken the sleeper caused the re-appearance of alpha activity. Spindles of electrical activity at thirteen to fifteen cycles per second were seen to occur as were periods when no waves appeared. It was noted that the patient lost the ability to follow the changing frequencies of a flickering light during sleep. Blake, Gerard and Kleitman (1939) described sleep changes in the EEG, and considered that the sleep changes were due to a shutting off of afferent stimuli by the thalamus and hypothalamus. Brazier and Finesinger (1945) noted the effect of barbiturates on the human /

human EEG. It was remarked that high voltage fast activity appeared in every case, and that if a larger dose of barbi-:turates was given, slow delta waves at three to four cycles per second appeared. Lennox (1946) described the effect of a wide range of sedative drugs on the human EEG. These drugs were given either orally or intravenously, and included pentothal sodium, sodium amytal, pentobarbitone, quinalbarbitone, phenobarbitons, chloral and paraldehyde. They all produced mainly fast activity.

Gibbs and Gibbs (1947) studied the EEG during sleep in five hundred epileptics. They examined them also while awake, and noted that 82% of the patients showed seizure discharges during sleep, but only 36% of the group exhibited them in the waking state. They considered that abnormal phenomena occurred either while the patient was falling asleep or waking. The incidence of seizure discharges was higher in focal than in idiopathic epilepsy. They stated that 95% of psychomotor epileptics showed seizure discharges in sleep, and 92% of patients suffering from petit mal epilepsy showed such phenomena. The chief weakness of this paper is that it gives no accurate description of the seizure patterns.

A further paper by the same authors (1949) described the use of quinalbarbitone (seconal). It was found to produce changes essentially similar to those of sleep in the human /

human EEG. It was not thought to enhance the frequency of seizure discharges. Wyke (1950) confirmed these results. The dosage used consisted of gr. 1½ to gr.4½. He described sleep changes in five healthy adults.

It has been shown recently by Merlis, et al. (1951) that the temporal lobe foci in psychomotor epilepsy can be demonstrated easily by means of sleep induced by seconal, paraldehyde, etc.

Conclusions.

There is no doubt that sleep facilitates epileptic seizures, but so far this has not been demonstrated, experimentally, to any very great extent. Recently, it has been shown to be of value in the demonstration of temporal lobe foci. As in other methods described before, sleep and barbiturates produce a change in brain metabolism. The normal individual shows occasional high voltage slow activity, associated with high voltage fast activity. It is possible that this is a caricature of wave and spike epilepsy which would facilitate the appearance of the true phenomenon. Also it is possible that the effect of sleep and these drugs is to remove cortical control, and allow the electrical activity of subcortical structures to become dominant.

V

Part I.

EPILEPTIFORM ABNORMALITIES PRODUCED BY STIMULATION OF NERVOUS PATHWAYS

This heading embraces much of the field of experimental epilepsy. Electrical methods of stimulation are among the commonest methods of use in the laboratory. They are of greatest value in investigating the physiological changes occurring in the epileptic fit, and they are of importance since they constitute the historical background to the methods in current use in the diagnosis of epilepsy.

In 1870, Fritsch and Hitzig showed that irritation of the anterior parts of the brains of animals by a constant current produced movements on the opposite side of the body. This work was followed up by Ferrier (1873) who produced epileptiform convulsions in animals by faradisation of the motor cortex. Later, when interest in the functions of different parts of the brain had been stimulated, Francois Franck and Pitres (1883) showed that faradisation of the optic cortex could produce motor fits in animals. The amount of current required was greater than when faradisation of the motor cortex was carried out and section of the brain between the optic and motor cortices could prevent the evolution of a seizure. These facts would seem to indicate that a physical mechanism of spread underlay the propagation of the fit. Much has been accomplished since these early papers were written /

written, and I propose to mention briefly, now, some recent work.

In 1947, Penfield and Jasper gave their views on the origin of the bilaterally synchronous electrical disturbances of petit mal. They considered that the diencephalon and perhaps the mesencephalon played a part in the genesis of these rhythms. It was thought that these regions had a somewhat more direct connection with the anterior portions of the frontal lobes of both sides than with other areas of the cortex. This was deduced from the fact that lesions of the inferior mesial aspects of the frontal lobes could produce generalised bilaterally synchronous rhythms. Later, Jasper and Droogleever-Fortuyn (1947), Droogleever-Fortuyn and Jasper (1947), described their experiments on cats in which the thalamic centres had been located by means of the Horsley-Clarke apparatus. These centres were stimulated electrically, and when the massa intermedia was stimulated three times per second, a cortical discharge of wave and spike activity at 3 cycles per second was produced in some animals.

The subsequent part of this section is concerned with a description of the epileptiform and other changes that can be produced by stimulation of one or other of the sensory modalities. Reflex epilepsy is a form of epilepsy which will be considered under this heading. This is defined as follows : /

follows: Brain, W.R. (1947) (p.892). It occasionally happens that a convulsion may be excited by some form of external stimulation. This may be a sudden loud noise - acoustico-motor epilepsy, or music - musicogenic epilepsy, or a visual or cutaneous stimulus.

One of the earliest forms of this to be noted was in the guinea pigs in which Brown-Sequard resected the sciatic nerves. They became subject to fits which were produced by irritation in their hind quarters. The irritation arose from the fact that the scratch reflex had been abolished, and multiplication of parasites occurred. The fit could be prevented by cleaning of the affected parts, or by injection of cocaine (Moruzzi, 1950). Epileptiform activity as a result of auditory stimulation has been described on several occasions. Thus Gowers (1901) mentioned an epileptic patient with an auditory aura in whom a fit could be induced by the sounding of a low organ note. Critchley (1937) described eleven patients suffering from musicogenic epilepsy, of whom he had knowledge, and nine cases from the literature. In a later paper (1942), he described two further patients. In one case, the attacks were produced by classical music, and in the other by the roaring of a blowpipe as well as by music. Emotional upsets were associated with the attacks. At this time, Lindsley, Finger and Henry (1942) described some experimental observations on audiogenic seizures in rats. They noted /

noted that fits occurred in 50% of unrestrained animals, but not in restrained animals. Masserman (1943) considered that the fits which could be produced in rats by the effect of sounds occurred mainly in animals so predisposed by heredity. Shaw and Hill (1947) described the history of a woman who suffered from musicogenic epilepsy. It was possible to obtain EEG records of these attacks in which high voltage bilaterally synchronous slow waves at 2½ to 3 cycles per second occurred. A fit was preceded by emotional upset. It was thought that the fit might have been produced by alkalosis as a result of overbreathing, but voluntary over-breathing failed to produce an attack. They considered finally that in this patient a conditioned response had been established, which was dependent upon the "meaning" value of the stimulus. It may be inferred, therefore, that the function of the cerebral cortex was involved since no fits were caused by pure tones alone.

Gastaut and Pirovano (1949) have attempted to assess the value of auditory stimulation in a group of patients who showed positive epileptic discharges on photic stimulation. However, the results proved disappointing. Arfellano, Schwab and Casby (1950) described two cases of epilepsy in whom EEG changes were produced by sonic stimulation. In one patient, the /

the EEG changes of psychomotor epilepsy with the negative spike in the left anterior temporal region appeared. This phenomenon was produced by a constant tone of 100 decibels at 1,024 cycles per second. These appearances vanished when the sound was turned off, and could be repeated at will.

Part 2.

THE PRODUCTION OF EPILEPTIC PHENOMENA BY STIMULATION OF OPTIC PATHWAYS.

Reference has been made earlier to the writings of the classical authorities on this subject. Galen and Apuleius both described the significant part whirling wheels played in the production of fits. Hippocrates was impressed by the effect of sudden strong sunlight in producing similar changes. Little was written about the clinical aspects of this phenomenon until recent years, although Gowers (1901) described a patient who had an epileptic fit on going out-of-doors into bright sunshine. He mentioned another patient in whom fits could be produced by looking at a bright light or into /

into a fire. Similar patients were described by Yawger (1914), Radovici, Misirliou and Gluckmann (1932) and Catola (1934). These writers all considered these effects to be due to the intensity of the stimulus. The effect of rapid repetitive visual stimuli was described indirectly by Holmes (1927), who noted the production of fits in susceptible individuals by the visual stimulation of the cinema shows of that period. His patients had old gunshot wounds of the occipital regions of the brain. The flickering effect of bright lights, such as neon signs, caused major epileptic fits in three patients described by Cobb (1947).

Against this clinical background, some physiological observations had been made on the effect of photic stimulation. The earliest one by Caton (1875) demonstrated that the shining of a bright light into the eye of an experimental animal produced an electrical discharge in that area of the cortex responsible for eyelid movements. It was shown clearly by Kornmuller (1932) that such a stimulus produced an electrical discharge in the striate area of the rabbit's cortex. The value of repetitive photic stimuli was demonstrated by Fischer (1934), who found these more effective than a single stimulus in producing definite action currents from the striate area. It was shown later that these action currents consisted of oscillations at roughly the same frequency as the stimulus. These /

These were recorded from electrodes over the occipital area of the intact skull, in man, when the eyes were illuminated by a bright, flickering light (Adrian and Matthews, 1934). It was found that the commonest range of this phenomenon was produced by a light flickering at between 9 and 14 flashes per second. (Durup and Fessard, 1935). This phenomenon of flicker following, or photic driving as some other authors named it, stimulated a great deal of interest, and it was noted by Halstead and his collaborators (1942) that the best results were achieved with flashes of an intensity of 80 foot candles and that the blue end of the spectrum was more effective than the red end.

Adrian (1944), in the Foyne Lecture, summarised his views on the significance of flicker rhythms. He stated that there was no agreement as to the cerebral mechanisms responsible for flicker rhythms. He pointed out that the flickering field must occupy the centre of the visual field before any of the cortical waves could be seen. If only half of the field of vision was stimulated, the flicker potentials appeared on the opposite side of the head. Similarly, if the upper half of the visual field was stimulated, the flicker potentials appeared in the lower part of the occipital cortex. No "on" and "off" effects were considered by Adrian to be present. He believed that flicker potentials were waves which /

which had spread out from the mesially situated striate area into the neighbouring parts of the cortex. He found that the forward spread in his own case was as far anterior as the lower frontal regions, and he ascribed this to local cortical changes and not to a potential gradient from the striate area. It was considered further that the spread of activity wasnot a purely electrical spread, but rather one through the neighbouring association areas. These findings have not been noted in animals, but Adrian considered that the fact that the animals had been anaesthetised interfered with the results.

In time it was shown that the flickering light stimulus could induce epileptiform changes in the EEG in a susceptible individual. Thus, Walter, Dovey and Shipton (1946) described an epileptic patient whose resting record contained large components at 8 cycles per second. When the light source (a Scophony Baird stroboscope) was triggered (by means of an electronic device) to produce a series of flashes which coincided with the appearance of EEG activity at 8 and 16 cycles per second alternately, a larval wave and spike discharge developed. These writers considered, therefore, that certain types of seizures were due to the exact synchronisation of cerebral rhythms previously slightly out of step. This discovery stimulated a great amount of interest and activity. It was thought that a new diagnostic tool was at hand, but

Walter /

Walter and Walter (1949) admitted that this method of provocation was ineffective in patients whose EEG record, at rest, showed no abnormalities. However, much of interest remained. The French workers investigated some patients of this type in great detail, and Gastaut, Roger and Gastaut (1948) described the examination of 100 epileptics whose history suggested that they might have fits on exposure to photic stimulation. 13 patients gave a positive response on being exposed to photic stimulation from a stroboscope during EEG examination. It is worthwhile pointing out, in order to emphasise the limited nature of this group, that all of the 100 patients were selected from the total number of 317 epileptics who passed through the clinic during the period of this investigation. It was thought that this smaller group would be most likely to respond to the test. In point of fact, the majority of the 13 patients described above had gross epileptic abnormalities when examined at rest or during overbreathing. These consisted chiefly of spike and wave complexes, but there is no doubt that photic stimulation increased the incidence of these abnormalities.

A machine designed to enhance the effects of photic stimulation was described by Gastaut and Morrial (1948). Briefly, a sound producing machine was triggered to emit sounds /

sounds in step with the stimuli from the stroboscope and on EEG examination an enhanced response was noted which spread forward from the occipital to the temporal regions. But there has been little written about the positive value of this approach in the diagnosis of epilepsy.

It was noted that photic stimulation could produce abnormalities in patients suffering from conditions other than epilepsy. Thus, Lerique-Koechlin, Mekhorocheff and Le Mansec (1950) found that epileptic wave forms were produced in a group of children suffering from choreo-athetosis and tuberculous meningitis as frequently as in a group of epileptic children, i.e., in one-third. However, these writers considered the appearance of high voltage slow activity to be a positive response as well as the demonstration of spikes or spike and wave activity. They made the conservative conclusion, however, that the test was only of diagnostic value if it provoked an attack of specific type. Walter (1950) noted that spike discharges could be produced by this method in patients without any previous history of epilepsy. At the same time, he described the combination of eyelid closure with the application of the stimulus as a most effective method of evoking epileptic discharges. The trigger device mentioned earlier (Walter, Dovey and Shipton, 1946), was used for this purpose.

In /

In a further paper, Walter (1951) claimed that 12% of patients referred for EEG examination following a history of attacks showed abnormalities on exposure to photic stimulation. This was a much more conservative estimate than that of Lerique-Koechlin et al. (1950), and is in keeping with the results of Gastaut, Roger and Gastaut (1948), who found positive responses in 13% of this group of patients. Walter noted four main types of abnormal response. These were (i) a diffuse dysrhythmia; (ii) wave and spike; (iii) large, brief spikes associated with myoclonus; and (iv) grand mal seizures produced by a coalescence of some of the patterns described above. This more limited description of abnormal responses possibly explains the discrepancy between the findings of Walter and those of Lerique-Koechlin and his co-workers.

Conclusions.

The pattern of the response to sensory stimulation has many closely-woven threads in its fabric. Some of these threads have been traced already in this thesis. Thus, it has been a fairly common clinical observation that appropriate stimulation of the sensory pathways in susceptible individuals could produce epileptic /

epileptic seizures. Sensory stimulation and especially repetitive photic stimulation of the optic pathways was found to produce action currents in the visual cortex which, in man, could spread forward to the frontal regions. It had been shown that electrical stimulation of the occipital areas could produce a generalised seizure through the effect (direct or indirect) of the spread of activity from the visual to the motor area. Repetitive electrical stimulation of the massa intermedia of the thalamus at 3 cycles per second could produce an epileptiform cortical discharge of wave and spike activity at 3 cycles per second (the pattern of idiopathic epilepsy). In man, epileptic activity is more easily induced by visual stimulation than by stimulation of any of the other sensory systems. It does not seem too far-fetched to postulate that the action currents, appearing at the occipital cortex following repetitive photic stimulation, can spread forward to stimulate epileptiform discharges from the thalamus which, in turn, may stimulate the parietal cortex to produce a major seizure. Fits produced by the action of sound are rare in man, but are much more common in certain species of rat living under certain conditions. These reservations apart, it seems likely that audiogenic seizures will occur more readily in the rat than in man because in the former the auditory cortex of the temporal lobe takes up a relatively greater proportion /

proportion of the brain than it does in man, in whose case the occipital (visual) cortex is relatively large and well developed.

Photic stimulation has been found to produce epileptic discharges in 12% to 13% of patients examined. However, it has been pointed out that it will not produce epileptic changes in patients with normal EEG records, hence its value as a diagnostic agent is slight. There is no evidence to show that it can delineate an epileptogenic focus, and its use seems to be limited to stimulation of the appearances of thalamic epilepsy or idiopathic epilepsy in susceptible individuals. It is important to remember that it can produce epileptiform discharges in persons without any family history of epilepsy, and without any previous history of attacks.

VI

METRAZOL.

This section will be devoted to a review of the use of this drug as a diagnostic aid in epilepsy. Some details will also be given of the combined technique of photic stimulation and metrazol injection.

Its pharmacological title is pentamethylentetrazol, and it is known under a variety of proprietary names, i.e., "Cardiazol", "Leptazol", "Metrazol", etc., but for the purpose of this review the name metrazol will be used throughout. It was elaborated by a German chemist, A.F. Schmidt, nearly thirty years ago. He was attempting to derive water-soluble substances from camphor and other ketones of the camphor group which would retain the therapeutic properties of camphor in spite of the change in physical characteristics. The active substance used was not camphor but cyclohexanone, which, among other products, yielded pentamethylentetrazol, or metrazol. This substance was found to have the following physical properties: A white crystalline powder of faintly bitter taste which melted at 58-59°C. It had a characteristic cherry wood smell, was readily soluble in water and the solutions were neutral in reaction. The substance was infinitely stable whether stored in solid form or in solution. Its use as a cardiac stimulant became widespread, but Camp (1928) demonstrated that it had no apparent effect on the normal heart, and considered that it exerted a /

a stimulatory action on the nervous system producing convulsions if a large dose was given.

This knowledge was made use of by Meduna (1935), who came to use metrazol in the convulsion treatment of schizophrenia in place of camphorated oil. He found an initial dose of 5 cc. (500 mgm.) effective in producing a convulsion, but an additional 1 cc. (100 mgm.) was necessary for each subsequent treatment. Kruger (1936) thought that 3 cc. (300 mgm.) metrazol was adequate to induce a seizure. Schonmehl (1936) considered that the normal subject required 10 cc. (1.0 G) to have a fit, but that schizophrenics needed only 5-7 cc. (500-700 mgm.)

Use was made of the drug in the diagnosis of epilepsy and Langeluddeke (1936) considered that the rapid injection of 5 cc. (500 mgm.) metrazol would produce convulsions in a large number of patients suffering from organic brain disorder, epilepsy or schizophrenia, and that the course of the fit in epileptics followed exactly the course of a spontaneous seizure. He found that 9 out of 14 epileptics had a generalised fit, and 1 out of 5 symptomatic epileptics had such a seizure. Stern (1936) thought that the slow intravenous injection of 2 cc. (200 mgm.) metrazol was of value in the diagnosis of epilepsy since this alone had no effect on non- /

non-epileptic patients. Schilling (1936) felt that some caution should be used in the application of this test. He gave 2 cc. (200 mgm.) to 3 patients as a cardiac stimulant, and produced an epileptic fit. Goldstein and Weinberg (1940) showed that the subcutaneous injection of 5 cc. (500 mgm.) metrazol per 100 lb./body weight produced fits in 47.05% of 34 epileptic patients, and in only 1.19% of 84 psychotic patients. Moismiser (1943) found that the rapid intravenous injection of 2 cc. (200 mgm.) metrazol produced a positive result in 32% of a group of 38 epileptic patients, whereas doses from 3.5 cc. (350 mgm.) upwards were required to provoke a seizure in non-epileptic patients.

The evidence in favour of this test is rather variable, but one thing seems clear, and that is that a certain proportion of epileptic patients, possibly not more than one-third, will have a seizure following the injection of 2 cc. (200 mgm.) metrazol. A slightly higher proportion would have seizures if the dose of metrazol was increased to 5 cc. (500 mgm.) Some non-epileptic individuals might have a seizure after an injection of 2 cc. (200 mgm.), but the general impression was that 3.5 cc. (350 mgm.) was the lowest dose capable of producing a fit in the normal person, although one /

one writer thought that at least 10 cc. (1.0 G) was necessary. However, the production of a seizure is often unpleasant for the patient, although it may be of great diagnostic value. Therefore, attempts were made to record the effects of metrazol electrically by means of the EEG. in the hope that it might be possible to observe a larval discharge of epileptic activity which would be of diagnostic value and would not necessarily produce a generalised fit. EEG. recording during metrazol-induced epileptic fits had been made already by Cook and Walter (1938), Strauss and Landis (1938) and Rubin and Wall (1939). All these writers described the presence of generalised slow activity prior to the onset of the seizure, but Rubin and Wall mentioned the appearance of spike and wave activity. All were agreed that the fit was accompanied by high voltage sharp waves or spikes, in either the tonic or clonic stages of the attack. The patients in the observations described above were all undergoing metrazol shock treatment, and the dosage of metrazol used did not appear relevant to these writers.

The first attempt to use metrazol in conjunction with the EEG. in the diagnosis of epilepsy was made by Ziskind, Sjaardema and Bercel (1946), who defined the minimal EEG. response to injections of metrazol as the first appearance of high voltage slow waves without evidence of a generalised seizure. /

seizure. This response was considered by them to be a means of measuring the convulsive threshold in human subjects. In a further paper, Ziskind and Bercel (1946) described the examination of 25 epileptic and 11 non-epileptic patients. Each patient received 10% metrazol intravenously at the rate of 1 cc. (100 mgm.) per minute, and it was noted that the average threshold dose, i.e., the dose required to achieve the minimal EEG. response defined above, was 2.3 cc. (230 mgm.) in the epileptic patient as compared with 3.4 cc. (340 mgm.) in the non-epileptic patient.

However, this approach was not made use of by Kaufman, Marshall and Walker (1940), who used the rapid injection, intravenously, of 2 cc. (200 mgm.) metrazol as a diagnostic device. This investigation was done in conjunction with EEG. examination, and the patients consisted of a group suffering from post-traumatic epilepsy, many of whom had focal lesions. This technique was contrasted with the action of over-breathing, hydration, electric shock, intravenous penicillin, sodium cyanide, acetylcholine, alcohol and tridione, but none of these other methods consistently induced EEG. changes of an epileptic character, although sodium cyanide produced generalised slow waves. Using metrazol alone, as described above, localised changes occurred in 60% of 97 post-traumatic epileptics which consisted of (a) slow waves /

waves, and (b) spikes which were single or multiple. In 10% of the group, generalised abnormalities appeared which consisted of single or multiple slow waves and spikes. These findings were the result of repeated use of the test. Less than one-half of the patients gave a positive response of localising value following a single metrazol activation. An interesting pointer to the variability of the response was the fact that some of the patients who had shown positive results on being first examined showed no response on re-testing. Nearly half of the patients examined were on anti-convulsant medication, and the test was effective in producing focal changes in 37.5% and generalised changes in 7.5%. Although this activation rate was lower than that of the group of patients who were not taking anti-convulsant drugs, no seizures occurred, whereas these were seen in 14% of the patients of the latter group in spite of the injection of sodium phenobarbital (0.26 G.) as soon as changes were noted. A small group of 11 post-traumatic epileptic patients was investigated, utilising the intramuscular injection of metrazol in a dosage of 0.6 mgm./Kg. body weight, but one patient had a generalised seizure and only two showed EEG. abnormalities of localising value, although nine patients in the group had shown EEG. changes following the intravenous injection of 2 cc. (200 mgm.) metrazol.

This /

This paper is probably the most important contribution to the subject to date, since the patients examined were suffering from symptomatic epilepsy, and the use of metrazol was of considerable value in demonstrating the presence of an epileptogenic focus in a high proportion of cases. This paper served to demonstrate that metrazol could activate focal abnormalities, although it could also produce generalised changes - a property it shared with the methods described in the preceding sections.

Attention was now devoted to refining the technique with the aim of improving its diagnostic efficiency and of minimising the possibility of seizures at the same time. It had been shown earlier (Barker and Levine, 1928), that the rate of detoxication of the drug was 0.83 mgm./Kilo body weight per minute. Therefore, if a diagnostic result was to be obtained, speed of injection and a dosage related to the body weight of the patient were important factors. These considerations appear to have been borne in mind by Gure, Rasmussen and Jasper (1948), who published a valuable contribution to the subject. They found that the rapid intravenous injection of 10% metrazol in a dosage of 2.4 to 2.6 mgm./Kg. body weight (i.e. 144 - 156 mgm. in an average patient weighing 60 Kg.), increased the incidence of abnormal discharges in 80% of patients with bilaterally synchronous wave and spike epilepsy. However, it was of little value in demonstrating the local changes in focal epilepsy /

epilepsy, and it produced generalised fits easily, hence, it was not considered to be a useful method. It was found possible to activate focal abnormalities without producing generalised changes by the injection of 5.5 - 6.8 mgm./Kg. body weight intramuscularly (3.30 to 4.08 cc. of a 10% solution in a patient weighing 60 Kg.) But this technique was not considered to be satisfactory because it was very painful, and the dose was difficult to control. Another method used by them consisted of the slow intravenous injection over a period of 5 - 10 minutes of a 2% solution of metrazol, which was given at the rate of 40 mgm. per minute until significant abnormalities appeared, or until 400 mgm. had been injected. This technique was claimed to produce focal changes in 93% of patients with localised abnormalities, and generalised changes in 100% of patients with an existing bilateral sharp wave or wave and spike pattern. EEG. changes occurred in 71% of patients with focal seizures, and clinical activation was seen in 67% of this group. These figures are somewhat similar to the results of Kaufman, Marshall and Walker, but the number of patients involved (21) is rather small to justify accurate comparison, and in any event one of the purposes of the later paper was to evaluate the effect of the drug on existing abnormalities, and not to use it as a diagnostic device. /

device. These authors were still dissatisfied with their methods since some epileptic patients were proving resistant to the slow injection method. Influenced by the findings of Kaufman, Marshall and Walker, they devised a new approach which combined the rapid injection method with the assessment of metrazol dosage on a body weight basis. Briefly, they gave a rapid initial intravenous injection of 1.0 mgm./lb./ body weight, which was followed in 30 seconds by another intravenous injection of 0.05 mgm./lb./body weight and successive similar injections were given at 30 second intervals until abnormalities appeared or until 400 mgm. had been injected. (In a subject weighing 160-lbs., the initial injection would be 1.6 cc. of a 10% solution followed by 0.8 cc. at 30 second intervals until 4 cc. had been injected). Even with this method, however, some patients remained remarkably resistant and others had seizures which did not resemble their habitual attacks.

One interesting point in this paper is that 31 control subjects were given an average dose of 390 mgm. metrazol by the slow intravenous injection method. Of these, only one - a schizophrenic - had a generalised fit, one, with a previous history of seizures in insulin coma therapy, showed sharp and slow waves at 2 cycles per second, and paroxysmal slow waves appeared in a further 6 control subjects, but these did not /

not appear to be considered significant. Thus, 23 (74%) showed no change whatsoever. These results are not necessarily valid for the normal person, since the control subjects consisted of a mixed group of non-epileptic psychiatric patients suffering from various disorders which may have their own specific convulsive threshold dose of metrazol.

An attempt to evaluate metrazol as a diagnostic technique was made by Roger, Roger and Pirovano (1949). They examined a large number of potentially epileptic patients who had normal EEG. records both at rest and following voluntary hyperpnoea. They considered that the injection of metrazol by the slow intravenous method was superior to the rapid injection technique, and obtained EEG. findings diagnostic of epilepsy in 40% of the patients examined.

A somewhat similar study was made by Merlis, Henriksen and Grossman (1950), who examined 57 epileptics with normal EEG. records. They injected 8 - 10 cc. of a 5% solution of metrazol (400 - 500 mgm.) in the hope of avoiding a seizure. They obtained positive results in 47% of the patients, and fits occurred in 7 patients (12.5%). Their results are somewhat similar to those of Roger, Roger and Pirovano, but it is worth noting that they considered the appearance of paroxysmal high voltage slow waves of diagnostic value as well as the appearance of spikes and spike and wave activity. /

activity. They considered the technique to be of value in demonstrating the unilateral origin of seizure discharges in symptomatic epilepsy. It was noted that there was a day-to-day variability in the response to metrazol. They examined, also, 38 control subjects, none of whom showed seizure discharges following metrazol, but these were all non-epileptic psychiatric patients, and the criticisms made already of the findings of Cure, Rasmussen and Jasper in this connection are still applicable.

All these investigators have been searching for the perfect technique which would produce EEG. abnormalities of diagnostic value without causing a fit, or without being too unpleasant for the patient. There was no doubt that the dividing line between a dose which would produce only EEG. changes and a dose which would produce a fit was extremely narrow. Attempts to devise techniques which would involve the use of very small doses of metrazol were therefore welcome, and thus it came about that the combined technique of photic stimulation and metrazol injection was devised. It has been shown already, in the preceding sections, that intermittent photic stimulation could be effective in producing seizure discharges during EEG. examination, but the idea of combining the two techniques appears to have arisen from the observation by Fulchignoni, (1938) that luminous stimulation of the retina facilitated /

facilitated the cortical action of strychnine in producing experimental epilepsy in dogs. Similarly, Gellhorn and Ballin (1948) in their work on picrotoxin convulsions in cats considered that optic or acoustic stimuli applied during picrotoxin injection produced an increase in amplitude of the action potentials of convulsive activity in the visual and auditory projection areas, and a spread of such activity to other unrelated parts of the brain. Clinical application of this knowledge was made by Remond and Gastaut (1949) who injected 5% metrazol intravenously at the rate of 50 mgm./ 30 seconds and simultaneously applied photic stimulation at frequencies between 3 and 30 flashes per second. They found that the injection of 400 mgm. metrazol produced myoclonus in the upper limbs and a burst of symmetrical frontal sharp waves in the normal person, whereas the threshold for this response (the myoclonic response) was lower in epileptic patients. In the light of the preceding papers on metrazol alone, this threshold would seem to be rather high when one considers that two methods of stimulation are being used together.

It was noted by Gallais, Planques and Miletto (1950) that the myoclonic response was obtained in a group of 24 hysterical patients by the injection of less than 500 mgm. metrazol in association with photic stimulation. Similarly, Corriol /

Corriol and Bert (1950) found that 14 out of a group of 30 schizophrenic patients were similar to epileptics in their response to the test. Gastaut (1950) revised the earlier estimate of Remond and Gastaut (1949) stating that upwards of 600 mgm. metrazol was necessary to produce the myoclonic response in the normal person, and that photic stimulation was best applied at frequencies of between 13 and 18 flashes per second. He confirmed the fact that responses could be obtained at a low threshold in idiopathic epilepsy, hysteria and schizophrenia, i.e., between zero and 400 mgm. metrazol. However, it was possible to distinguish between idiopathic epilepsy and the other groups since slow waves accompanied the spikes in the former condition simulating the appearance of wave and spike activity, and the latter groups were characterised by the appearance of polyspikes. A similar low threshold in association with polyspike activity occurred in epilepsy secondary to diencephalic lesions. Epilepsy secondary to a cortical lesion (including psychomotor epilepsy) tended to have a myoclonic threshold above the normal level, but it was stated that a local cortical reaction often occurred at an earlier stage, although the paper does not evaluate this matter in detail. Indeed, it seems doubtful if this combined approach is of any value in demonstrating the site of an epileptogenic focus, and where metrazol is necessary to elicit changes /

changes, the dose appears to be as high as, if not higher than, the dose used by other investigators who injected metrazol without photic stimulation. But Gastaut disarms criticism by stating categorically that this technique is not a method of diagnosing epilepsy, but rather a means of exploring certain subcortical structures such as the thalamus and diencephalon.

In spite of these observations, a search for an improved method continued, and Remond (1952), using the term PHOMAC, described a technique in which metrazol was injected intravenously in suitable dilution at a dosage of 30 uG./Kg./ body weight per second. One cc. of this solution was injected every 30 seconds, and photic stimulation was applied at 15 flashes per second in the form of an orange-red coloured flash of 10 candle power/sec./sec. (at eye distance). The duration of each flash was one m.sec., and stimulation was applied for about 20 seconds after each metrazol injection, with the eyes opened and closed. He claimed to be able to demonstrate the appearances of idiopathic epilepsy by the use of very small doses of metrazol (i.e., 0.1 - 3 mgm./Kg. (6 - 180 mgm. in a patient weighing 60 Kg.), and by means of slower injection, i.e., at the rate of 10/uG./Kg./sec. he was able to show the foci of temporal lobe epilepsies. However, he quoted little evidence to support his contentions, although it is probably too soon to evaluate the test in adequate detail. The change of /

of approach to a method based on body weight would seem to indicate a certain dissatisfaction with the technique used previously, but this is not mentioned by the writer. Indeed, Gastaut (1952) stated again that the chief value of the combined approach in the form of PHOMAC was not in the diagnosis of epilepsy but rather to enable a distinction between the varieties of epilepsies to be made, and to delineate the allied disorders of hysteria and schizophrenia. There is no doubt that Gastaut has used this approach (as will be shown subsequently) to cast new light on the function of the thalamus and other subcortical structures, but he has produced little evidence to show that it is in any way superior to methods previously described in the diagnosis of epilepsy, and the evidence in favour of its ability to delineate epileptogenic foci is slender indeed. However, he has stated that with the use of PHOMAC the induced convulsion rate in his clinic had fallen to 2% - a figure lower than that of most other investigators, and therefore a factor in favour of the test.

There is a wealth of experimental evidence underlying the use of metrazol, but the work on the combined approach of photic stimulation and metrazol injection has been done almost entirely by Gastaut and his co-workers. However, recently Bickford et al. (1952) discovered that the myoclonic response of /

of Remond and Gastaut could be obtained from needle electrodes implanted in the orbital and facial muscles without any comparable changes appearing in the occipital cortex. This was seen in normal subjects following photo-metrazol acti-:vation, and it was thought that it was subserved by pathways other than the photo-convulsive response. Gastaut (1952) countered this finding by distinguishing between the fronto-rolandic and the fronto-polar response to PHOMAC, the former being cortical in origin and the latter palpebral in origin. There the matter rests for the moment. There is no doubt, however, that both photic stimulation and the injection of metrazol are capable, separately and together, of inducing generalised seizure discharges.

Metrazol was used first in medicine by reason of its alleged stimulating action on the cardiovascular system, and it was thought that the production of fits was secondary to vascular changes. Thus, Denyssen and Watterson (1938) thought that the fits were caused by vasoconstriction, and showed that metrazol-induced seizures could be aborted by the use of vaso-dilating agents such as amyl nitrite, sodium nitrite or histamine. But Forbes and Mason (1940) were able to observe the pial vessels during metrazol convulsions in experimental animals by means of a cranial window. They noted vaso-dilation occurring, and saw no sign of vaso-:constriction in the fit. It was shown further by

Libet /

Libet, Fazekas and Himwich (1940) that the effect of vasodilating drugs was to produce such a dilution of metrazol in the blood stream that it was difficult for the drug to achieve a concentration sufficient to produce a fit. However, large doses of metrazol could overcome the effects of dilution. Jasper and Erikson (1941) thought that changes in cerebral blood flow and pH. values found in cats during metrazol convulsions were secondary to the greatly-increased cortical activity. There seemed little evidence then to support the view that metrazol achieved its convulsion-producing effect by a specific vascular action, and there has been even less evidence subsequently. Cook and Walter (1938) considered that metrazol had a "poisoning" effect on the cortex, and formulated the theory that when a certain concentration of metrazol was reached in the brain, the frontal areas became unstable and acted as a detonator for the rest of the cortex which had been already poisoned by the drug. Later, it was shown by Goodwin, Kerr and Lawson (1940) that metrazol applied locally to the cortex could initiate seizure discharges in rabbits, although their latent period was much longer than when metrazol was given intravenously. So far, there has been little evidence to show what the nature of this local response is, but Cure, Rasmussen and Jasper (1948) postulated that the action of metrazol was to produce a change in /

in the polarisation or permeability of the nerve-cell membranes. No definite evidence has been produced to support this viewpoint, but no other theories of note have been advanced.

The work reviewed already has shown that the appearances of idiopathic epilepsy can be induced relatively easily by a variety of methods, indeed, more easily than the changes of focal cortical epilepsy. It was remarked by Cure, Rasmussen and Jasper (1948) that patients with epilepsy secondary to deep-seated lesions showed an easy facilitation to metrazol injection similar to that of idiopathic epilepsy, whereas patients with cortical lesions reacted much less readily. This observation suggested to them that the onset of the discharges of idiopathic epilepsy might be in sub-cortical structures, and that the sub-cortical regions of the brain might be especially sensitive to activation by metrazol. This viewpoint is opposed by the recent work of Shimizu, Refsum and Gibbs (1952), who demonstrated that it was easier to produce a bilaterally synchronous petit mal discharge in the cat by injecting metrazol into the common carotid artery of one side, than by injecting the drug into the vertebral artery on one side. It is assumed that metrazol injected into the vertebral artery would reach the thalamus and related structures via a branch of the posterior cerebral artery, whereas metrazol injected into the common carotid artery would go /

go principally to the cortex. Hence the petit mal discharge is more likely to be produced by the cortex than the thalamus. The contention of this paper that the thalamus is not necessary for the production of a bilaterally synchronous rhythm ignores the possibility that such a rhythm may be due to the interaction between cortex and thalamus. The fact that metrazol can produce little in the way of generalised activity following local application to the thalamus is not disputed. This has been shown already by Goodwin, Kerr and Lawson (1940), and Gastaut and Hunter (1950) were rarely able to produce a spread of seizure discharge beyond the thalamic nuclei when they injected this drug into the thalami of experimental animals.

Another viewpoint was given by Johnson and Walker (1952) who showed that monkeys with experimental cortical lesions had a lowered fit-threshold to metrazol injected intravenously or applied locally. A tendency for spikes to appear more readily at the sites of the lesions than elsewhere was remarked on, but it was noted that the spread of spike activity to the adjacent cortical areas and to the opposite hemisphere was extremely rapid. They believed that related cortical and sub-cortical structures had been rendered more sensitive to stimulation by reason of the lesions.

The /

The effect of repetitive photic stimulation in producing electrical discharges from the occipital cortex which may summate to produce epileptiform activity has been described in an earlier section (V. Part 2). There is some evidence that metrazol has a more pronounced effect on this part of the brain than elsewhere. Thus, Goodwin, Kerr and Lawson (1940) showed by the local application of metrazol to the rabbit's cortex that the drug produced greater activity in the sensory cortex than in the motor cortex. It was demonstrated by Toman, Goodman and Swinyard (1946) that metrazol injected intravenously in unanaesthetised rabbits in a dosage 50%- 75% of the convulsant dose produced an episodic slow wave dysrhythmia in the visual cortex, and larger doses were necessary to produce a spike and dome dysrhythmia in the motor cortex. The same authors noted that the combination of metrazol injection in cats, with centripetal stimulation of the sciatic nerve, produced an enhancement of the sensorimotor discharges on the cortex. In the light of this evidence it seems feasible that the combination of photic stimulation and metrazol injection would produce a greater amount of electrical activity in the visual cortex than either method used separately. But whether such combined activity would lead more readily to epileptic discharges than either method separately is open to conjecture.

It /

It has been shown already that a seizure discharge from the motor cortex can be produced in this way (Remond and Gastaut, 1949), i.e., by combined metrazol injection and photic stimulation, but little was known about the pathway of the spread of electrical activity from the occipital to the frontal cortex. By recording from a subcortical electrode (utilising a patient with an existing burr-hole following air-ventriculography), Gastaut (1950) was able to show that the response of epileptic activity to combined photo-metrazol stimulation reached the thalamus 5 - 10 m.secs. before it reached the frontal cortex. In a series of experiments on cats under nembutal anaesthesia, Gastaut and Hunter (1950) showed that the spread of response to combined stimulation was through the lateral geniculate body to the visual cortex, thence to the medial thalamic nuclei and the frontal cortex. Isolation of both visual cortices by peripheral incision had no effect on this pattern of spread, and it was necessary to freeze or ablate both visual cortices before it could be abolished. Ablation or freezing of the visual cortex on one side plus longitudinal section of the corpus callosum did not affect the pattern of spread in the undamaged hemisphere, and led to only a slight attenuation of the response in the hemisphere without a functioning visual cortex.

In /

In another interesting experiment, they showed that the local application of metrazol to the visual cortex combined with repetitive photic stimulation produced an enhancement of sharp wave activity, and suppressed all other activity, including a very slow wave form seen previously with photic stimulation alone. It was necessary to inject metrazol intravenously while applying photic stimulation before the slow wave activity was seen at the visual cortex, in association with the sharp wave, or spike. On these findings, they indicated the possibility that the sharp wave or spike activity was a function of the cortex, and that the slow wave arose from subcortical structures. As a result of their experiments on the timing of the spread of epileptic activity, they postulated the presence of at least three pathways by which the thalamus could be reached, all of which arose from the optic tract between the retina and the visual cortex. There is no doubt that they have shown that the spread of activity from the visual to the frontal cortex is not through adjacent cortical areas, but whether that spread is entirely through the thalamus or not remains an open question.

Conclusions /

Conclusions.

A number of workers has shown in recent years that epileptics will have fits more readily than normal people after the injection of a small dose of metrazol. This increased tendency to convulse seems to be shared to a lesser degree by schizophrenics and possibly by hysterics. EEG examination in conjunction with metrazol injection has lent some confirmation to this belief. This has shown that metrazol injection will produce slow waves and spikes which may appear separately or together, and which may be focal or generalised. Opinions vary about the significance of slow activity. Some writers considered that its appearance was a diagnostic sign of epilepsy. However, a more conservative viewpoint would give slow activity a diagnostic connotation, only if it appeared in relation to a focal abnormality. There is ample evidence to show that the use of metrazol is of some value in delineating focal abnormalities, but these local changes tend to become generalised very rapidly indeed, which rather limits the value of the technique.

The ability to induce generalised wave and spike activity is one which metrazol shares with other provocative methods, notably, voluntary hyperpnoea, insulin hypoglycaemia, forced /

forced hydration and photic stimulation. To these different methods various modes of action have been ascribed from alterations in the function of the nerve cell to hyper-:synchronisation of thalamo-cortical rhythms. Most writers are agreed that wave and spike activity induced by these methods occurs very easily in epileptics, but there is some evidence to show that it may occur almost as easily in certain schizophrenics and hysterics. A recent paper by Smith, Anderson, Healey and Greenblatt (1952), claimed that the rapid intravenous injection of 150 mgm. metrazol (or, in some cases, a slightly larger dose), produced wave and spike activity at 3 cycles per second in 33 per cent. of a group of 48 non-epileptic psychiatric patients. That response may well be the reaction of the schizophrenic or hysterical patient. Again, it is possible that there is a normal distribution curve of metrazol sensitivity in the population at large, but from the figures of all the investigators quoted above there seems to be no doubt that epileptic patients tend to cluster on the initial rise of the curve.

The combined approach of Phomac is of great interest, but one would have expected an easier facilitation of epileptic discharges, by this method. Since this is not so, it is possible /

possible that epileptic patients are divided into groups which include separate photic-sensitive and metrazol-sensitive divisions. One important asset of the combined method is its extremely low seizure production rate.

The work of Gastaut and Hunter (1950) would seem to suggest that the spike, of spike and wave activity, arises from the occipital cortex, and the slow wave from subcortical structures. This viewpoint is an interesting one, but it does not explain the initial appearance of a unilateral cortical slow wave discharge in focal epilepsy. It does not fit in either with the work of Jasper and Droogleever-Fortuyn (1947) who produced spike and wave activity at 3 cycles per second by electrical stimulation of the massa intermedia of the thalamus three times per second. Of course, it may be argued that Gastaut and Hunter's results were due to the method used, namely, photic stimulation and metrazol, and that their results were specific only for that method and could not be applied to other aspects of epilepsy.

VII.

MISCELLANEOUS METHODS.

This section is concerned with reviewing a collection of papers on various methods of provoking epileptic phenomena. The series is not necessarily a completely comprehensive one.

One of the earliest observations was by Astley Cooper (1836), who showed that if the vertebral arteries in the dog were tied off, subsequent carotid compression produced convulsions. The injection of 2 drops of absinthe into the jugular vein of an anaesthetised animal was noted to produce a fit by Gotch and Horsley (1891). The local application of creatin or of cane sugar to the cortex of animals resulted in convulsions, as was discovered by Maxwell (1906), who thought that the fits could not be due to these substances alone, because of the marked latency of the response. The value of strychnine in facilitating reflex discharges from the cortex was described by Amantea (1921). Lithium salts in the form of the iodide, sulphate or perchloride, were found by Moracci (1931) to have an epileptogenic action when applied to the cortex of the dog.

Camphor has been known to have convulsive properties for many years. Medicinal doses of camphor monobromide produced fits in two epileptic patients described by Radovici, Schachter and Kisilev (1937). High voltage waves followed by seizure discharges were noted during E.E.G. examination of four epileptic /

epileptic patients who received an intravenous dose of 0.5 - 1 c.c. of a camphor preparation (homocamfin) (Gibbs, Gibbs and Lennox (ii)(1937). Acetylcholine injected intravenously was shown by Williams (1941) to increase the amount of epileptic activity in epileptic patients during EEG. examination. Prostigmine and large doses of eserine also served to enhance petit mal activity on the EEG (Williams and Russell, 1941). It is possible that this result is due to the presence of acetylcholine in quantities greater than normal in the brain. Acetylcholine in excessive amounts has also been implicated as the cause of seizures in dogs fed on agenised (bleached) flour (Belford and Bonnycastle, 1950). It is suggested that nitrogen trichloride, the bleaching agent, produces an increased synthesis and consequent accumulation of acetylcholine. The story of the epileptogenic qualities of agenised flour is of some interest. Erikson, Gilson, Elvehjem and Newell (1947) had observed EEG abnormalities in dogs fed on a commercial preparation of wheat gluten. In one animal, large slow waves and spikes were seen, and the general impression of the abnormalities was that they resembled the inter - /

inter-seizure EEG. findings in epilepsy in human beings. These writers were unaware of the significance of this discovery, and they were also unaware, at the time of writing, of the observation by Mellamby (1946) that canine hysteria - or convulsive attacks in dogs - could occur in animals fed on bread made from flour which had been bleached by nitrogen-:trichloride (agene). No attacks were seen in dogs fed on untreated flour. EEG. abnormalities of an epileptic type were seen in dogs fed on a diet of flour bleached by nitrogen-trichloride (Silver, Zevin, Kark and Johnson, 1947), and similar changes were observed in animals fed on a diet of amino acids treated by nitrogen trichloride (Silver, Monahan and Klein, 1947). Therefore, it would seem reasonable to assume that nitrogen trichloride was an epileptogenic substance, and that flour bleached by this chemical (agenised) could bring about convulsions in dogs.

Some other drugs have been found recently to have epileptogenic properties. It has been shown by Duff and Hutchinson (1952) that l-noradrenalin can increase spike and wave activity in epileptic patients, whereas adrenalin is ineffective in this way. The group of patients examined all showed a similar increase in epileptic activity following overbreathing. Atebrine, used in the treatment of malaria /

malaria, was found to have a convulsive effect in seven patients described by Newell and Lidz (1946), although only one of these patients had a previous history of fits. Streptomycin, when applied to the cortex of experimental animals, produced convulsions (Buckle, Liebenow and Orth, 1947). It was noted further that the tendency to convulse increased proportionately with increases in the potency of the drug. Scopochloralose - a combination of scopolamine and chloral - was considered to be a drug of value in the diagnosis of epilepsy by Delay, Baruk, Verdeaux and Verdeaux (1950). It produced drowsiness, and was thought to be efficacious in delineating EEG abnormalities of a focal nature.

Conclusions. /

Conclusions.

The only definite conclusion to be drawn from this assembly of information is that fits can be induced by a very wide variety of agents which have but little in common together. The view that acetylcholine in concentrations greater than normal will tend to produce fits is an interesting one. It is worth noting that in the section on voluntary hyperpnœa, Barrow and his co-workers claimed that the cerebral instability produced by this test was due in part to an inadequate supply of acetylcholine. However, neither viewpoint necessarily excludes the other.

CLINICAL INVESTIGATION.

The patients described in the following sections were examined by at least one of the methods detailed below.

INSULIN HYPOGLYCAEMIA: This was used effectively on one patient only, Mr.G.A.L., who was having insulin coma therapy for schizo-phrenia and who was given a standard coma dose of 200 units soluble insulin, intramuscularly, on the day of the test.

"SECONAL" SLEEP: The preparation of secobarbital sodium, made by Eli Lilly & Co., was used in the way described by Wyke(1950): an oral dose of three grains was given to an adult and one and a half grains to a child. The dose was repeated if sleep changes did not appear in the record within forty minutes.

METRAZOL: This was given according to, the method described by Cure, Rasmussen and Jasper(1948), in a foot-note to their paper. This was as follows: a 10% solution of Metrazol was used, (this was supplied by a variety of makers and was known variously as cardiazol, leptazol, metrazol, etc.,). Five cc. of the solution was drawn up into a graduated syringe. The solution was injected intra-venously and the dosage given depended on the patient's body-weight. It was 0.1 mgm./lb. initially, and 0.05 mgm./lb., at 30 second intervals until 400 mgm. had been injected or until epileptiform abnormalities had appeared. Thus if the patient weighed 140 lbs., an initial injection of 1.4cc. was given, followed by injections of 0.7cc. at half minute intervals. (Some of the non-epileptic patients were given slightly larger amounts of the drug.)

PHOTIC STIMULATION: This consisted of repetitive flashes of high intensity from a gas filled tube which gave a blue coloured light. The machine used was a standard Scophony-Baird stroboscope. Stimuli were applied at all frequencies between four and twenty flashes per second, the patient having the eyes closed throughout, and then the procedure was repeated at each frequency, the stimuli being applied at the moment of eye-closure. If metrazol had been given, without success, photic stimuli at frequencies between 13 and 18 flashes per sec. were given again, at times to coincide with eye-closure.

SCOPO-CHLORALOSE/

SCOPO-CHLORALOSE: This was given orally as described by Delay, Haruk, Verdeaux and Verdeaux(1950). The record was followed for one hour after the drug had been given.

ADDITIONAL NOTES: (1) Voluntary Hyperpnoea had been used on all the patients described prior to referral for these tests. It had not been of diagnostic value in any patient.

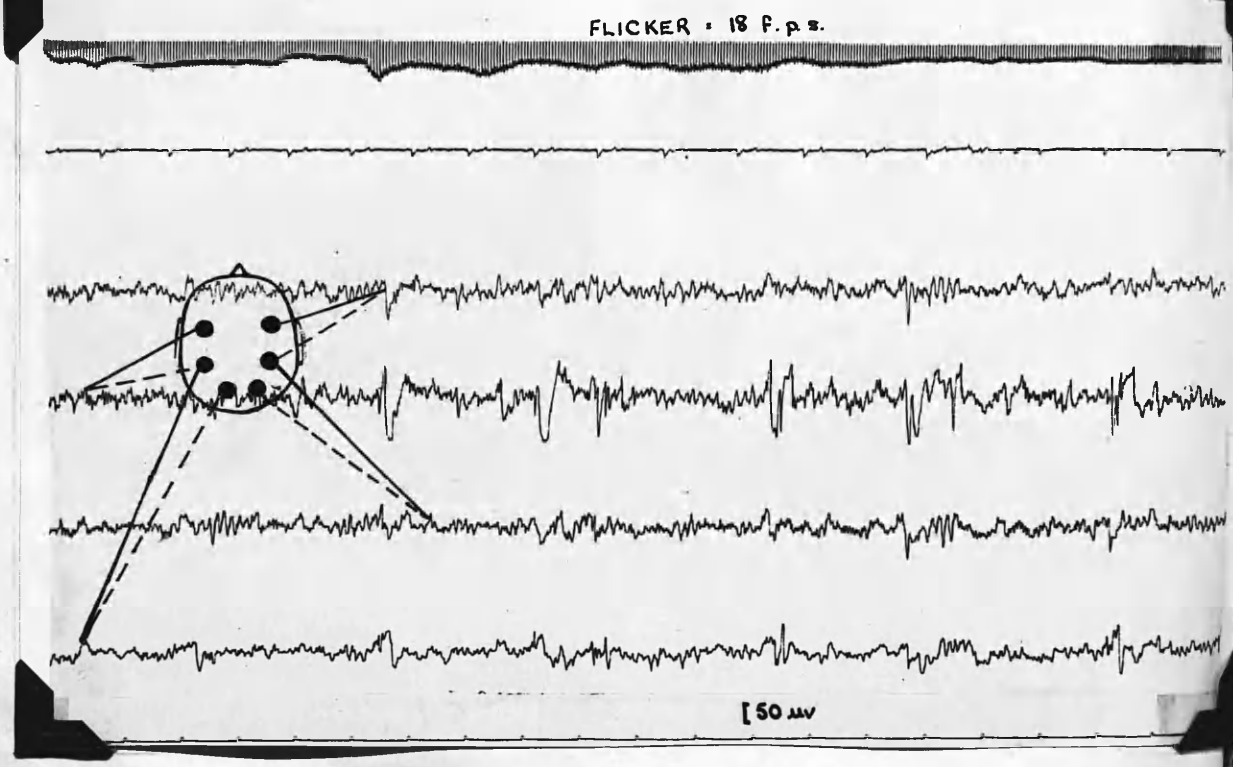
(2) The two patients who had seizures following oral "Seconal" should not have been included, strictly speaking, among those with normal resting records. However, since they received neither photic stimulation nor metrazol, their inclusion there does not invalidate the test results for these latter drugs. There is no doubt that these findings with "Seconal" were of great clinical value.

(3) As will be seen, the patients were examined on a variety of EEG machines. These were as follows: (a) Six-channel Ediswan, (b) three-channel Grass, (c) a two-channel apparatus, made by the technical staff of the Maudsley Hospital and (d) a six-channel apparatus made by the technical staff of St. Thomas' Hospital.

In the case of the two-channel apparatus it was not possible to record photic stimulation, simultaneously by means of a selenium cell, as with all the other machines. Therefore a tracing of photic stimulation at the appropriate frequencies has been superimposed on the two-channel records, in order to demonstrate the pattern of events more graphically than the notes pencilled on the record would have done.

I

The patients described in the following pages consist of a small group who showed epileptiform abnormalities on routine examination. The action of the provocative methods on them is described.



A.B:-Generalised high voltage spike discharge on applying photic stimulation at I8 flashes per second following the injection of 300 mgm. metrazol.

Master A. B. Aged 14 June, 1950.

Reason for referral:

he investigation of fainting attacks which he had had since the age of ne year.

amily history:

is was essentially negative and his personal history was uneventful.

story of Present Illness:

r the previous twelve years, he had regularly experienced attacks in ich he suddenly became red in the face and lost consciousness. He was conscious only for a few seconds. Occasionally the attacks were preceeded laughter, which he appeared to be unable to control. There was no story of tongue biting or of incontinence.

examination:

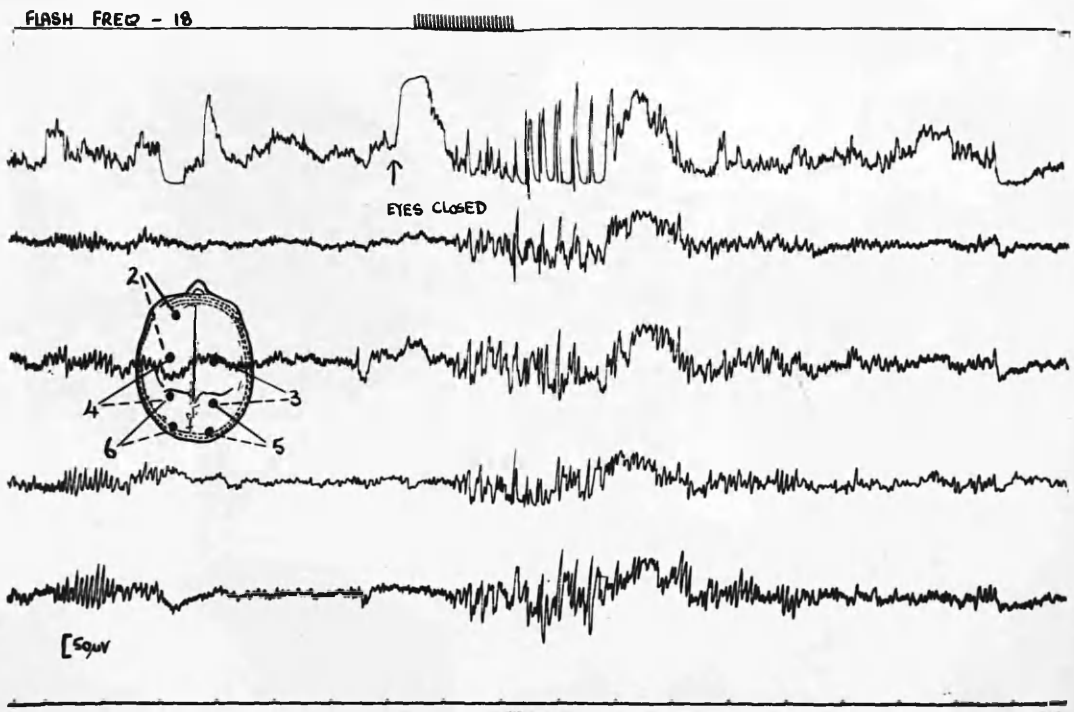
ere was no physical or mental disorder present.

ecial Investigations:

ll x-ray showed no abnormality.
.G. resting record showed the presence of occasional bursts of wave and ike activity. The use of photic stimulation alone produced no change, nor d the injection of 300 mgms. of metrazol. However, the application of hotic stimulation at 18 fbs following the injection of metrazol produced generalized burst of high voltage spike activity.

rogress:

here was no doubt that this patient was suffering from idiopathic epilepsy. bsequently, in 1951, it was noted that he was suffering from major seizures n which he lost consciousness, bit his tongue and was incontinent. His ttacks proved rather resistant to treatment with anti-convulsants, and ontinued to occur at regular intervals.



W.O:- Spike discharge evoked by the combination of eye closure and photic stimulation at 18 flashes per second.

Reason for referral: The treatment of fits which he had had since the age of twelve, and which had become increasingly frequent.

Family history: Father became psychotic at age 56, following bankruptcy, and died in a mental hospital at age 71. Mother was 66. She left her first husband with seven children, and subsequently bore three illegitimate children to patient's father. She had had numerous nervous breakdowns. One sister was a mental defective and a maternal aunt was an epileptic.

Personal history: He was a premature baby. Nothing was known of his early development. He had terrifying hypnagogic hallucinations as a child. His mother brought him up harshly until he went to an orphanage at the age of five. He was an average scholar, and left school at age fourteen, since when he had had many frequent changes of job.

Previous personality: He was a passive, immature boy, with few outside interests.

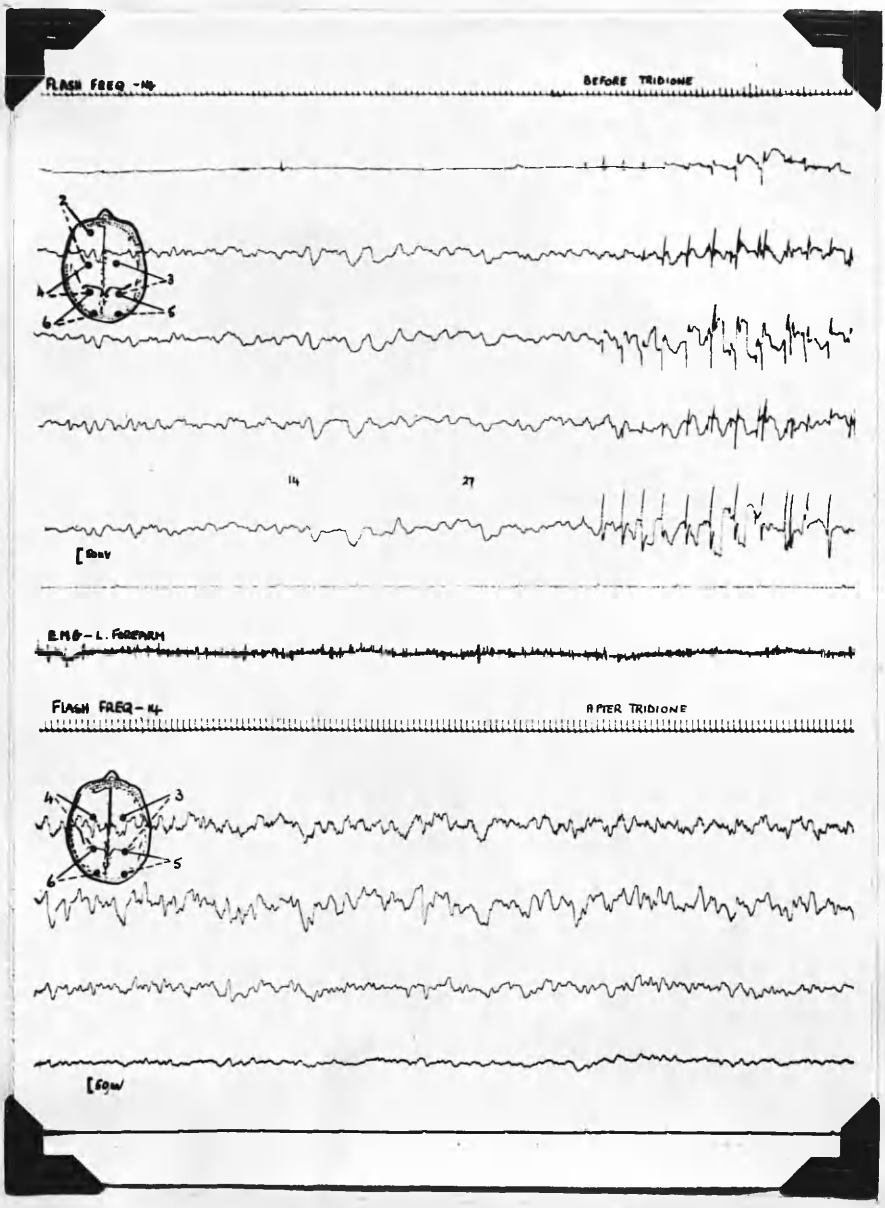
History of present illness: At the age of twelve he suffered from temper tantrums, which after six months gave place to major epileptic fits. There were controlled to two or three attacks per year by epanutin until about a month previously, since when he had had six major fits. He had also had attacks which were possibly psychomotor in type. In these, he committed anti-social acts, such as ringing up girl telephonists in order to swear at them, and stealing a motor car in Bristol and driving it to London. On another occasion, he attacked policemen without any provocation. On each of these occasions he had rapidly recovered himself, and offered himself up for arreat.

On examination: Physical: There was no abnormality. Mental: A pleasant, quiet man, who was mildly depressed. There was no evidence of deterioration.

Special investigations: W.R. - Negative. E.S.R. - 6 mm. Skull X-Ray - Normal. I.Q. Matrices 83. EEG. Frequent bursts of bilaterally synchronous spike and wave activity at 3½ cycles per second were seen. This was increased by combining photic stimulation with eye closure.

Progress: The patient's fits were very well controlled by a combination of epanutin and phenobarbitone, and a place was found for him as an assistant steward in a hostel. He was considered to be suffering from idiopathic epilepsy which was of psychomotor type.

He continued to live in a rather erratic manner, with frequent changes of employment. In the summer of 1950, while working at the London Zoo, he had a quarrel with, and attacked, a rather cantankerous canteen assistant who died as a result of the attack. The patient was charged with manslaughter, but in view of his history of epilepsy, he did not receive a prison sentence, and was committed to a mental hospital.



M.E.P:- Unverricht's myoclonus epilepsy.Upper half shows spike discharge on photic stimulation at I4 flashes per second.Lower half shows effect of Tridione in inhibiting such a discharge.

MISS M.E.P. (27) 25.7.49.

Reason for referral: She had had fits and jerking movements of her limbs for fifteen years.

Family history: Her father was a haemophiliac and had intermittent left facial spasm. A maternal aunt became paralysed in both legs and died at the age of forty.

Personal history: Her early life was uneventful, but she left school at the age of thirteen because her illness had begun then.

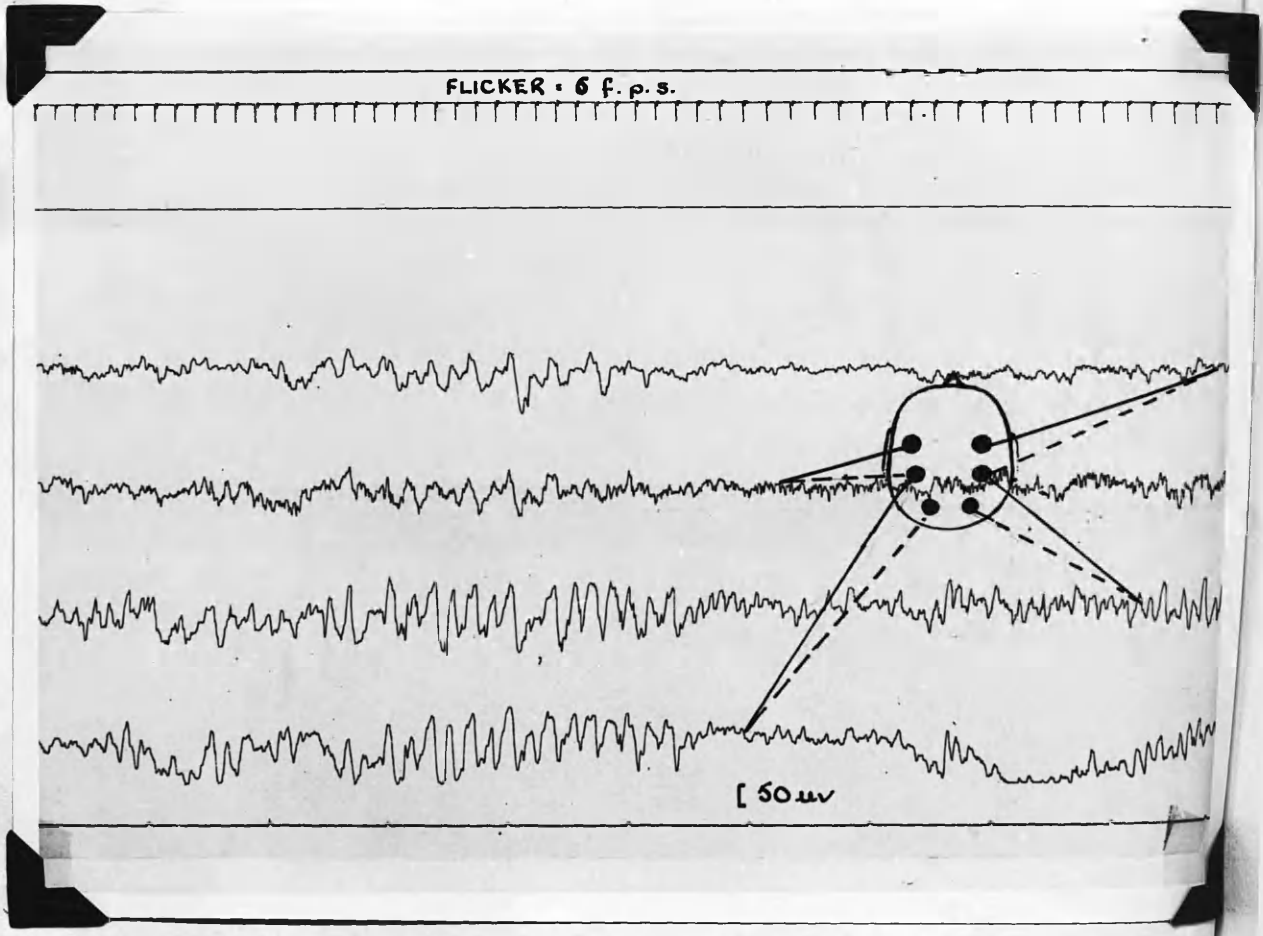
Previous personality: She had been a happy child, and had wanted to become a nurse.

History of present illness: At the age of twelve she began to have sudden attacks of weakness in her limbs. These attacks persisted. Six months later she began to have epileptic fits which were preceded by paraesthesiae in the left arm. She had also non-purposive intermittent jerkings of all four limbs. In 1946, she began to have attacks of unconsciousness, some of which lasted for as long as thirty-six hours. In 1947, it was noted that she had some dysarthria, her speech was irrational and she complained of being persecuted. She was doubly incontinent. Her condition deteriorated gradually. She found it difficult to talk, and she could hardly swallow, so that it became impossible to treat her at home.

On examination: She was grossly emaciated, and had severe acne of the face. Myoclonus of the muscles of her limbs and face was present. She had a spastic quadriplegia. Her voice was a faint whisper, and it was difficult to distinguish words like "yes" and "no".

Special investigations: W.R. - Negative. E.S.R., Serum bromide, blood count and C.S.F. were normal. EEG. The resting record showed spike complexes in association with myoclonus. These could be produced by photic stimulation, Tridione inhibited these discharges.

Progress: In view of the history, a diagnosis of Unverricht's myoclonus epilepsy was made. She was put on tridione which controlled her myoclonic attacks to some extent, and she had physiotherapy for her spasticity. She continued to deteriorate, and died in February, 1951.



D.T:- Atypical spike and wave discharge initiating major seizure following photic stimulation at 6 flashes per second.

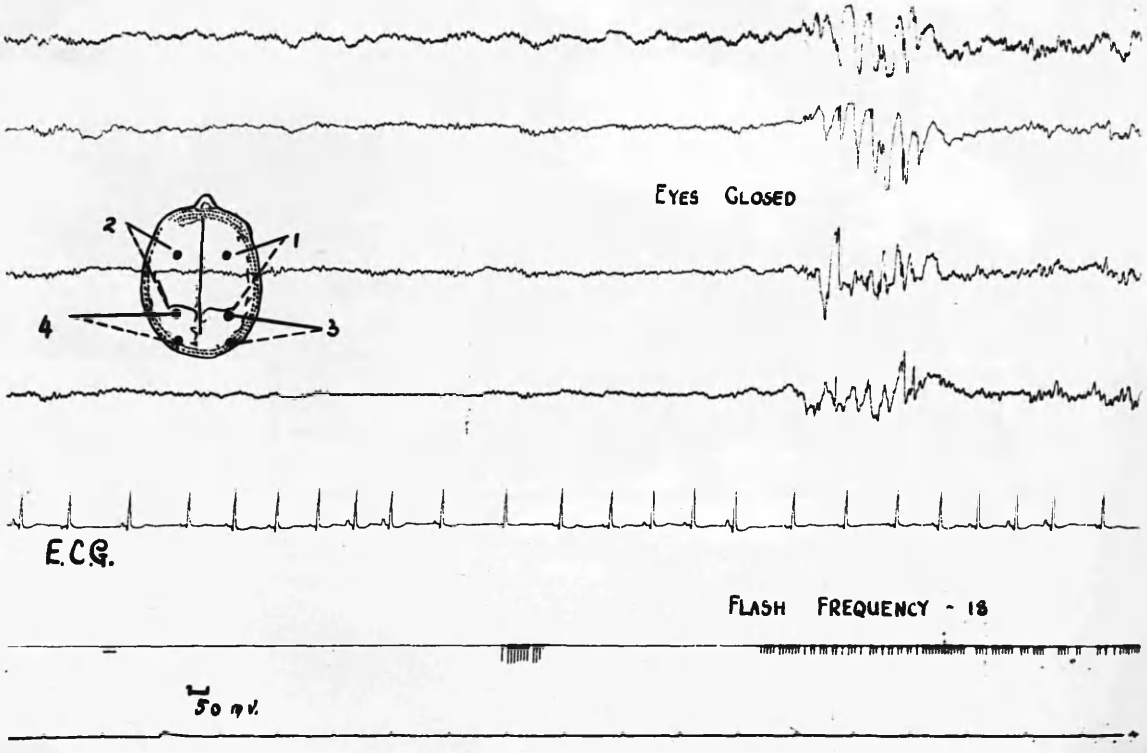
Master D.T. (14)

This boy was a mental defective who had suffered from epileptic fits since birth. There was no relevant family history. His development had been extremely slow . He had been ascertained as a defective and was considered to be at the idiot level. Since in-fancy he had had frequent fits.At first he had had minor attacks in which the loss of consciousness was only momentary, but in recent years he had been having major seizures characterised by a tonic phase,followed by a clonic phase and associated with tongue biting and incontinence. He had not responded adequately to treatment with epanutin and phenobarbitone and his attacks were reasonably controlled only by a bromide mixture.

On examination:- there was no physical abnormality of note.Mental examination was difficult in view of his mental defect but there seemed no doubt that he was an idiot.

Special investigations:- Skull X-Ray was normal.EEG:-The resting record showed frequent bursts of bilaterally synchronous, atypical spike and wave activity.Photic stimulation at 6 f.p.s. produced such a burst of abnormal activity and was followed by a major seizure.

Progress There was no doubt that he was suffering from epilepsy which the records suggested to be idiopathic in nature.



M.M.W:- Atypical spike and wave discharge induced by photic stimulation at 18 flashes per second.

Miss M.M. W. (10) 15.11.44.

Reason for referral: A complaint of nervousness, backwardness and faints of recent onset.

Family history: There was no relevant abnormality.

Personal history: She was an unwanted child, but her birth and early development were normal. She had suffered severely from a number of illnesses, including mumps, german measles, chicken-pox and acidosis. She had been at school since the age of five, but her performance had been poor.

Previous personality: She was an affectionate, friendly child, who was not afraid of air-raids as she was too young to understand their significance.

History of present illness: She had had three attacks of fainting, one two years earlier and two in the previous six months. In the attacks, she became unconscious, and her eyes were slightly glazed. They were thought to be hysterical in nature.

On examination: No physical abnormality was noted, apart from the fact that her heart rate was rather rapid. Mental: She was a backward, dull child, who showed some stereotypy of behaviour.

Special investigations: I.Q. 71. EEG. - A paroxysmal appearance which was suggestive of idiopathic epilepsy.

Progress: In December, 1944, she had a fainting attack in which it was noted that her heart rate was about 160 per minute. Sir Adolphe Abrahams saw her, and made a diagnosis of paroxysmal tachycardia which interacted with her cerebral dysrhythmia to produce epileptiform attacks. It was recommended that she should be admitted to a school for mental defectives, and if thought necessary she should have anti-convulsant medication. Subsequently, in 1947, she was admitted to Lingfield Epileptic Colony, where she remained reasonably free from attacks on epanutin gr.1½ b.d. In May, 1949, she was seen in a faint in which she was grey and pulseless. Her admission to the Maudsley Hospital for further investigation of this attack took place in October, 1949, when she was fifteen years old. It was noted then that she was showing signs of pubertal changes with the development of hirsuties on the limbs. Her general behaviour was unchanged. A skull X-Ray and Air Encephalogram showed no changes of note, but EEG. examination demonstrated the presence of bilaterally synchronous spike and wave activity at four cycles per second, the incidence of which could be increased by photic stimulation at eighteen flashes per second, but no changes in pulse or respiration rates occurred.

Her /

Progress (contd.)

Her E.C.G. showed some paroxysmal fast activity, but was otherwise normal. Her intelligence level had probably remained fairly static, and her performance was now - Wechsler, verbal I.Q. 58, performance I.Q. 43 and full-scale I.Q. 45. Perimetry showed a right nasal quadrantic defect.

It was noted that if her maintenance dosage of epanutin gr.1½ b.d. was reduced gradually, two types of attack ensued: (i) in which she had a paroxysmal tachycardia, the heart rate being at 140 per minute. This type of attack lasted for ten or fifteen minutes. (ii) In which she collapsed, showed marked pallor, dilated pupils, her heart sounds were imperceptible and respiration ceased. Respiration recommenced in association with a generalised vaso-dilatation.

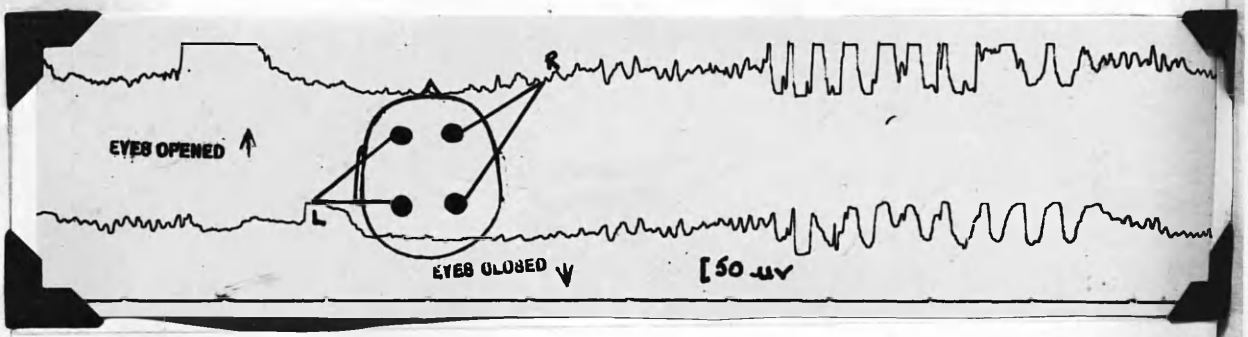
She was sent to Maida Vale Hospital for Nervous Diseases, where the Air Encephalogram was done. It was thought that she might have had a lesion which angiography might have revealed, but this was considered a risky procedure in a patient of this type, and so it was not done.

After these investigations, she returned to Lingfield Epileptic Colony. Provisionally, she was considered to be a mental defective who was suffering from idiopathic epilepsy in which the discharge of electrical activity was through the hypothalamus. In the attacks in which cardiac arrest appeared to occur, it was thought likely that a massive, sympathetic discharge was taking place, in which the heart was fibrillating too rapidly for the sounds to be heard.

On reaching the age of sixteen, she left Lingfield. She was seen again in out-patients in January, 1951, when she was put on epanutin gr.1½ b.d. She continued to be relatively free from attacks, but in June, 1951, she had an attack as she was leaving a cinema, and died.

At post-mortem, a pineal cyst was found to be blocking the Aqueduct of Sylvius.

The use of the various provocative methods on a group of epileptic patients who had shown no abnormality on routine examination, is described in the following pages.



D.C:- Bilaterally synchronous spike and wave activity after the injection of 300 mgm. metrazol.

Miss S.C. (13) 20.4.50.

Reason for referral: The investigation of fainting attacks which she had had since infancy.

Family history: Both parents were rather elderly, the father being 65 and the mother, a very nervous woman, 53.

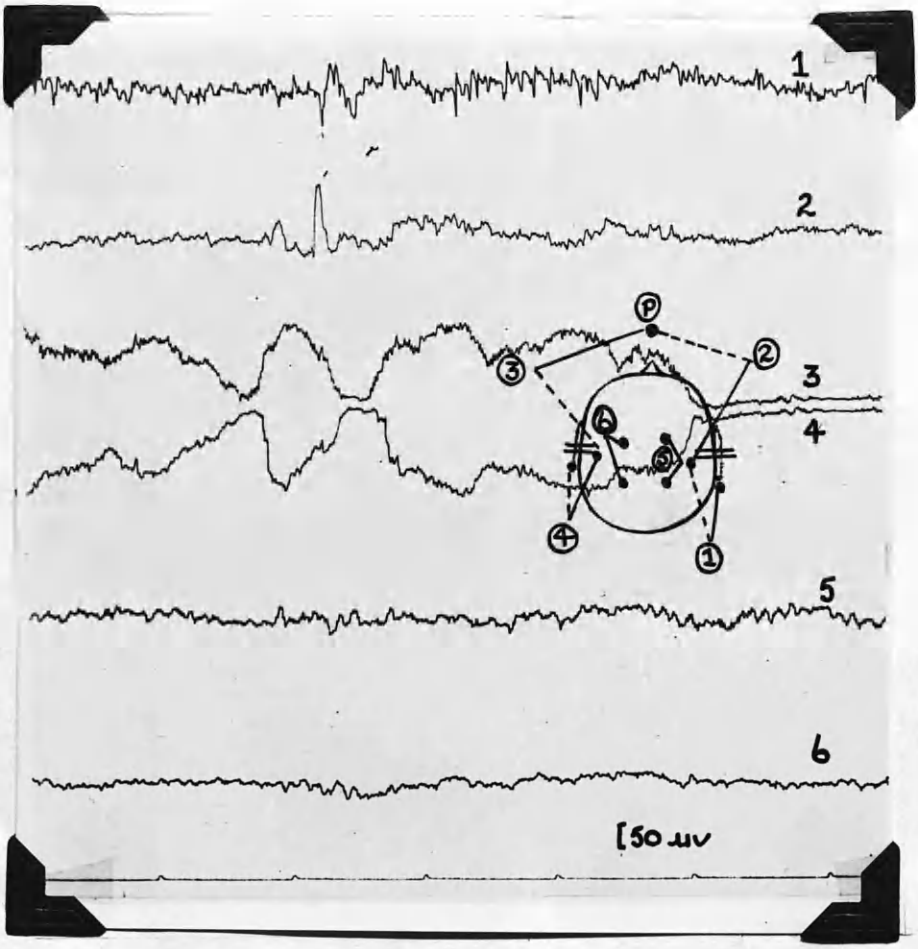
Personal history: Her birth was normal, and apart from the fainting attacks she had had no serious ill-health. She had been rather backward at school. Menses began at the age of twelve.

History of present illness: Shortly after birth, she began having attacks in which she stared, clenched her fists and became cyanosed. She was never incontinent in these attacks, which continued at regular intervals. Often, she had as many as three attacks per day. At the age of eight, fainting attacks began, which occurred even if she were sitting down. At the age of twelve, after the onset of the menses, she displayed a marked interest in the opposite sex. She began to wander away from home, and on one occasion she stole £3 from her father. Her parents charged her before the magistrates as being in need of care and protection, and she was transferred to the Remand Home. She was placed on probation, provided that psychiatric treatment was given.

On examination: There was no physical abnormality, and she appeared to be a friendly, cheerful girl.

Special investigations: Intelligence: Matrices I.Q. 95. EEG. - The resting record contained a dominant alpha rhythm, but some fast and slow activity was present also. Photic stimulation produced no change, but the injection of 300 mgm. metrazol produced a burst of bilaterally synchronous spike and wave activity.

Progress: Following the above tests, she was considered to be suffering from idiopathic epilepsy, and in June, 1950, treatment with epanutin and amphetamine sulphate was begun. The attacks ceased almost immediately, and when seen last in March, 1952, there had been no further recurrence of her fits of fainting. She was about to leave school to start work as a book-binder.



G.H.C:- Spike discharge at Right tympanic electrode following injection of 200 mgm. metrazol.

P = pharyngeal electrode.

Mr. G.H.G. (32) 1.6.50.

Reason for referral: The investigation of fits which had begun in 1946.

Family history: His father was subject to mood swings, and one of his brothers, who died in infancy, was hydrocephalic.

Personal history: His early life was uneventful, apart from the fact that he was found to be anaemic at the age of eleven, and was sent to an open-air school. Later, he became a clerk with N.A.A.F.I., and during the war he served in the Central Mediterranean, returning to his clerical job after the war. He was married, and had two children.

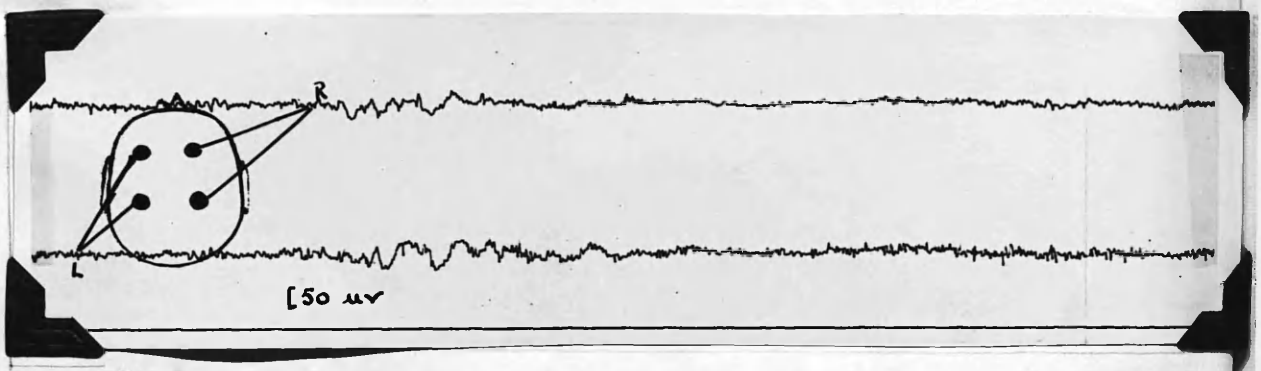
Previous personality: He was always a quiet, reserved individual.

History of present illness: Four years earlier, he had begun to have fits characterised by lip-biting, swallowing, facial pallor and transient disorientation. About once a month he had a series of such attacks - usually three in one day. Treatment with epanutin and phenobarbitone was begun in 1948, but his attacks continued.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. X-Ray of skull and muscles was normal. EEG. - The resting record was normal, and photic stimulation alone produced no change. 280 mgm. metrazol was injected in divided doses over a period of 1½ minutes. 40 seconds later, photic stimulation at 15 flashes per second was applied, which immediately induced an automatism with lip-licking and swallowing movements. The attack lasted for 40 seconds, and the patient was subsequently amnesic for it. The record was obscured by muscle artefacts, but some high voltage slow activity at 3 - 4 cycles per second was noted, which was generalised but was more marked in the right hemisphere. The test was repeated using tympanic and pharyngeal electrodes. After the injection of 200 mgm. metrazol a focal disturbance began in the right hemisphere, which was seen as single spikes located to the right tympanic electrode. This was followed by a continuous shower of spikes from this region, but no clinical fit developed.

Progress: Following these investigations, he was sent to Maida Vale Hospital for air studies, but an air-encephalogram revealed no abnormality. While an in-patient, two fits occurred, one of which followed the pattern described above, and the other was not fully observed since it occurred when he was asleep. He continued to attend as an out-patient, but his fits recurred at regular intervals, in spite of treatment with epanutin, phenobarbitone and dextro-amphetamine sulphate. A final diagnosis was made of epilepsy characterised by seizures of uncinate type.



Mr.G.D. Generalised slow activity and a single bilateral spike after the injection of 200 mgm. metrazol. This was followed by a major seizure.

Reason for referral: For the treatment of fits which he had had since the age of fifteen.

Family history: One brother suffered from psychoneurosis.

Personal history: As far as was known, his birth and early development were normal. He had tuberculosis, and was an in-patient at a sanatorium, between the ages of five and seven. His school and employment records had been poor. Work of a labouring type had been his form of employment, but he had had frequent changes of occupation. He worked last as a cinema doorkeeper two years earlier. Job changes have been due to his fits. He had been married for eight years, and had one child born prior to the marriage. This child was having treatment for nerves in a Child Guidance Clinic.

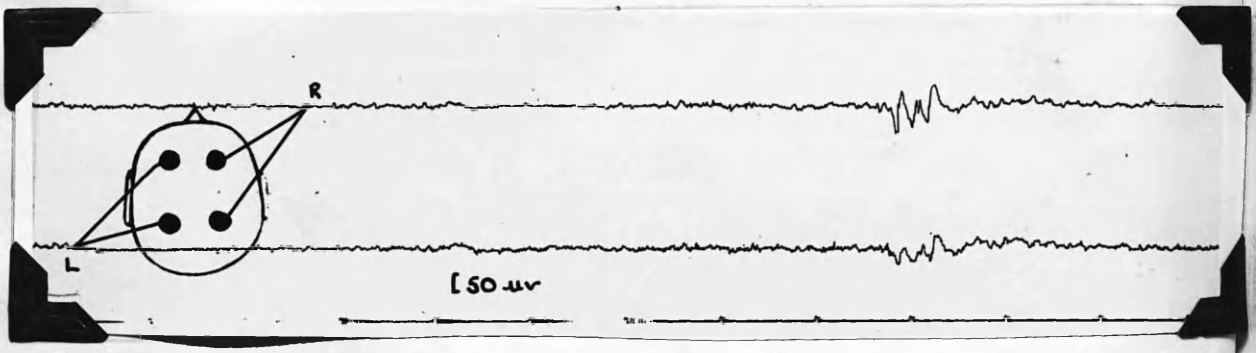
History of present illness: The patient had suffered from fits for many years. He was examined at the National Hospital for Nervous Diseases, Queen Square, in 1948, where it was noted that he had had fits since 1914, that phenobarbitone helped him most, but epanutin tended to upset him. His wife stated that the only warning he got of an attack was a "jumpiness" of his limbs. His arms began to shake and his legs went stiff. He groaned and went limp as if in a heavy sleep. Then he changed colour and became blue all over. At times he had bitten his tongue and been incontinent. The frequency of the attacks was about once per week. Practically all the attacks had begun while he had been asleep. His wife complained that he had been sitting about at home doing nothing but reading murder stories. She was afraid that he might murder her and the child.

On examination: There was no physical abnormality. He appeared to be a fairly reasonable person with whom it was possible to establish a fair rapport.

Special investigations: Skull X-Ray - Normal. EEG. - The resting record was normal, apart from some bilateral slow activity at 4 cycles per second. Photic stimulation produced no change, but the injection of 200 mgm. metrazol produced generalised slow activity at 5 cycles per second, followed by a single spike and a major seizure.

Progress: An attempt was made to treat him again with phenobarbitone and epanutin. These drugs he tolerated fairly well, and the frequency of his attacks was reduced to two per month. However, in spite of being registered a disabled person, he had difficulty in finding employment, and ceased to attend in November, 1950.

Diagnosis: Idiopathic epilepsy.



G.D:- Burst of atypical spike and wave activity after the injection of 480 mgm. metrazol.

Mrs. G. D. (52) 1.2.50.

Reason for referral: She complained of fits which she had had since the age of thirty-eight.

Family history: There was no relevant information.

Personal history: Her early life had been normal. She had done factory work for ten years after an average school career. At the age of twenty-two, she had married, and subsequently she had three children. The menopause was reached at the age of fifty-one.

Previous illnesses: She had had attacks of rheumatic fever at the ages of fourteen, twenty-three and thirty-eight. Following the last attack, she underwent tonsillectomy.

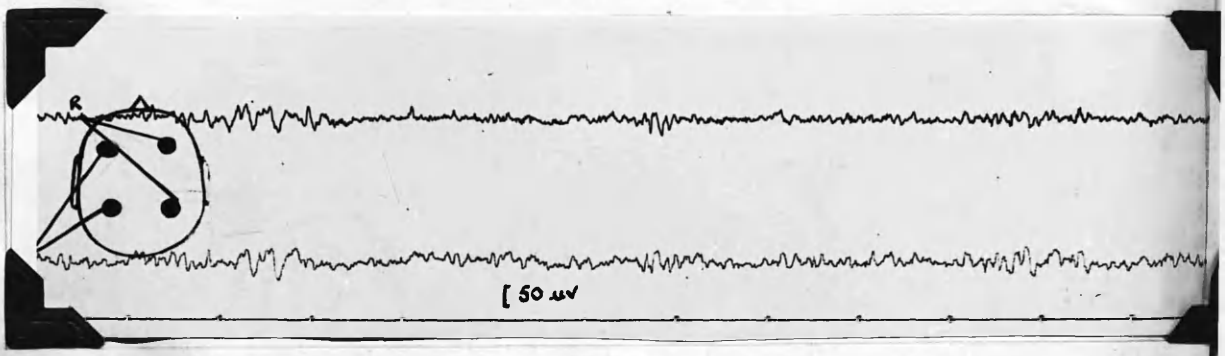
Previous personality: She was considered to be a placid, hard-working woman with no neurotic traits.

History of present illness: Fourteen years earlier, she had been in hospital for tonsillectomy. On coming out of the anaesthetic, she was told that her favourite child had been killed by a horse. This, naturally, upset her considerably. Three weeks later, she had her first fit. Since then, she had had them regularly at the time of her period, although this correlation had ceased with the menopause. She had an aura, in which she thought of a distant person or of a distant object, and she had a compulsion to bring this distant object nearer. Then, half-a-minute later, she always had her fit in which she jerked all over, was incontinent and often bit her tongue. On recovery, she was always confused, and had a severe headache over the right temple. Recently, the attacks had occurred as often as three times in one day. They were more liable to occur if she had been disturbed emotionally.

On examination: There was no physical abnormality, but she appeared to show marked anxiety.

Special investigations: EEG. - The resting record showed some frequency instability. Photic stimulation produced no change, but the injection of 480 mgm. metrazol produced a burst of high voltage spike and wave activity.

Further progress: Treatment with epanutin and phenobarbitone was begun, and the frequency of her attacks soon began to diminish. By September, 1951, she had been free from attacks for as long as six months. When seen in August, 1952, she had had only three attacks in eighteen months, and each of these had occurred in association with a febrile illness.



R.E:- Bilaterally synchronous atypical spike and wave activity after the injection of 400 mgm. metrazol.

Mr. R.E. (32) 15.12.49.

Reason for referral: History of blackouts which began about nine months earlier.

Family history: His father was being treated for venereal disease at the time of patient's birth.

Personal history: His birth and early development appeared to have been normal. His school record was good. He served in the Palestine Police before the war, and during the war he was in the Merchant Navy as a seaman. More recently, he had been a gas fitter, and since February, 1949, he had worked as a mining engineer in Canada. He was married, and had two children.

Previous illness: In 1943, he was treated at Sutton Emergency Hospital for the effects of "shock". Apparently he had begun to have headaches after experiencing a severe barrage in a Malta convoy in August, 1942. The attacks were preceded by a heavy feeling on the right side of the head, then haziness over the eyes, followed by unconsciousness. He had these attacks four to six times per week, and cut himself on several occasions. At times he had visual disturbances in which he saw white and yellow edges to objects. He was upset by loud noises, ship's bell, telephones and the sound of rivetting in dry dock. No physical disorder was found, and E.E.G. examination showed no abnormality. He was considered to be a hysteric, who was suffering from the effects of 'shock'. A combined course of insulin and continuous narcosis was given. He was not thought to be fit to return to sea, and he was discharged on a disability pension. His headaches and blackouts recurred some nine months later, and eventually, in 1945, he was re-admitted to Sutton Emergency Hospital. On that occasion, a diagnosis of hystero-epilepsy was made, although there was no change in the physical findings. Then he was given a course of modified insulin therapy. He was examined in 1946, and again in 1948. No outstanding change was noted, and it was remarked that he was suffering from psycho-neurosis with hysterical attacks of unconsciousness. Late in 1948 he had an accident at work in which he lost the tip of his right index finger. Little was known about the details of the accident, but he obtained £1,500 in compensation.

History of present illness: Early in 1949, he went to Canada to settle. When in the backwoods of Saskatchewan, he began to have blackouts lasting from half-an-hour to six hours. In one of these, he fell and broke his dental plate. Subsequently, he was examined at various medical centres in Canada, but no abnormality was found. He returned to this country, and was seen again at the Maudsley Hospital in December, 1949, where the following special investigations were carried out :

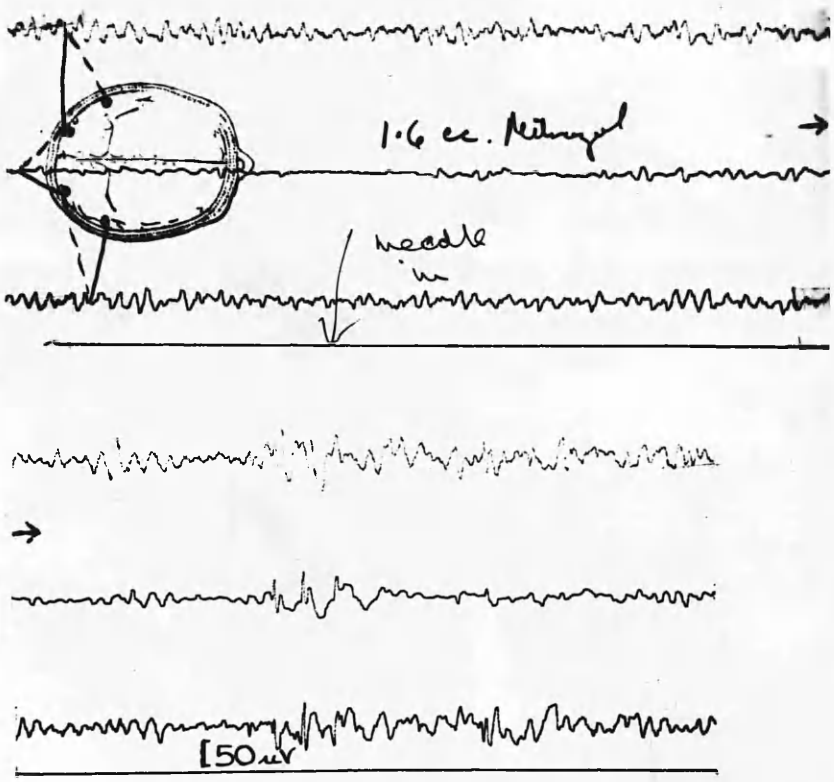
Skull /

Skull X-Ray - Normal. EEG. - The resting record was normal. The administration of seconal gr. 4½, and photic stimulation, produced no change. Following the injection of 400 mgm. of metrazol, a burst of high voltage, bilaterally synchronous spike and wave activity was seen.

Progress: As a result of these tests, it was considered that he was an idiopathic epileptic whose attacks were precipitated by emotional stresses. No anticonvulsant medication was given to begin with. Subsequently, he obtained employment as a travelling salesman, but the attacks continued, and he was seen on occasions in out-patients in a state of confusion which was considered to be ictal in origin. An attempt was made to treat him with epanutin, but this merely aggravated matters, and it was found that he was helped best by a combination of sodium amytal and amphetamine sulphate. In 1951, he complained of double vision, and on examination he was found to have some paresis of the left external rectus muscle, for which there was no apparent cause.

His social behavious deteriorated, and he took to drinking to excess. On one occasion, his wife appeared in out-patients to complain about his behaviour. She said that he was drinking a lot, and had frequent outbursts of rage. At times he had threatened suicide. His relationship with his wife had deteriorated, and he had been demanding anal intercourse.

In view of these developments, it was thought that he might be suffering from temporal lobe epilepsy. In June, 1952, he was requested to re-attend for further examination, but nothing was heard from him.



G.F:-Bilaterally synchronous, atypical spike and wave discharge produced by the injection of 160 mgm. metrazol.

Reason for referral: A recent attack of trembling in his hands and legs. This was associated with a vision of a dead soldier in his room.

Family history: His father was an alcoholic and his mother suffered from epilepsy.

Personal history: His early life was normal, and he did well at school. Subsequently, he worked as a barman and was latterly manager of a public house. During the war, he served in the Royal Marines from 1939-1945 and saw active service overseas.

Previous illness: He fractured his skull in 1947, but there were no complications.

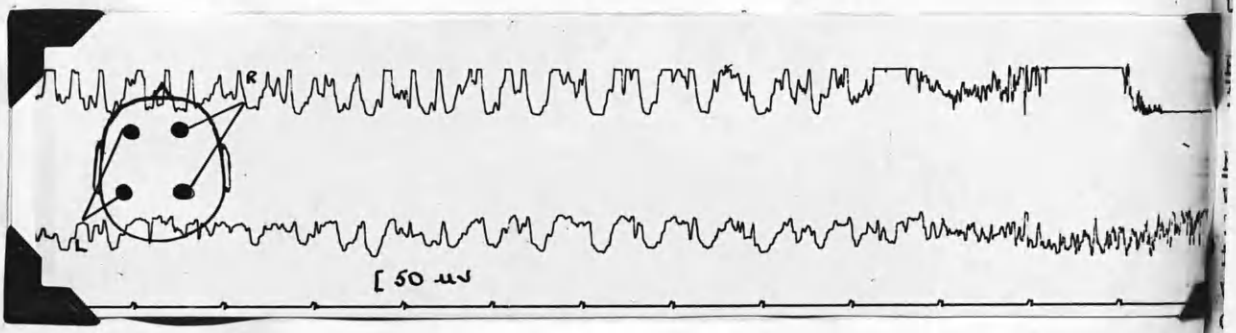
Previous personality: He was a happy, cheerful, friendly person, but was excessively sensitive.

History of present illness: Six months earlier, he had begun to have attacks of depression associated with trembling movements of his limbs. These continued, and two nights before admission he saw visions of dead soldiers walking round his room. These had occurred for two nights consecutively.

On examination: There was no physical abnormality. He appeared to be excessively anxious. There was no evidence of deterioration.

Special investigations: W.R. - Negative. E.S.R. blood count, and blood bromide were essentially normal. C.S.F. - normal. X-rays of chest and skull were normal. EEG. - The resting record was normal. Photic stimulation produced no change, but the injection of 150 mgm. metrazol produced a high voltage spike discharge which was of greatest amplitude in the right hemisphere.

Progress: It transpired that he was a passive homosexual, and that he was living under considerable strain because he was making great efforts to avoid sexual contacts. The epileptic factor was disregarded, and it was considered that he was suffering from hysterical fugue states in relation to anxiety about his homosexuality. An attempt was made to treat him by psychotherapy, but this did not prove successful. He was admitted to an Observation Ward in February, 1952, having made a suicidal attempt, because he was disappointed by his failure to find a suitable job.



H.G:- Bilaterally synchronous,atypical spike and wave initiating major seizure after the injection of 200 mgm. metrazol.

Miss H.G. (28) 14.8.50.

Reason for referral: The investigation of epileptiform behaviour which she had had since adolescence.

Family history: Her father suffered from fainting attacks.

Personal history: She had many neurotic traits in early life, nail-biting, night-terrors, enuresis and so on. On leaving school at fourteen, she went into domestic service, and was in the Auxiliary Territorial Service for a few months. However, a great part of the time had been spent in prison where she had been serving gradually increasing sentences for petty larceny. Her last sentence had been a term of six years for making an unprovoked attack on a woman who had befriended her.

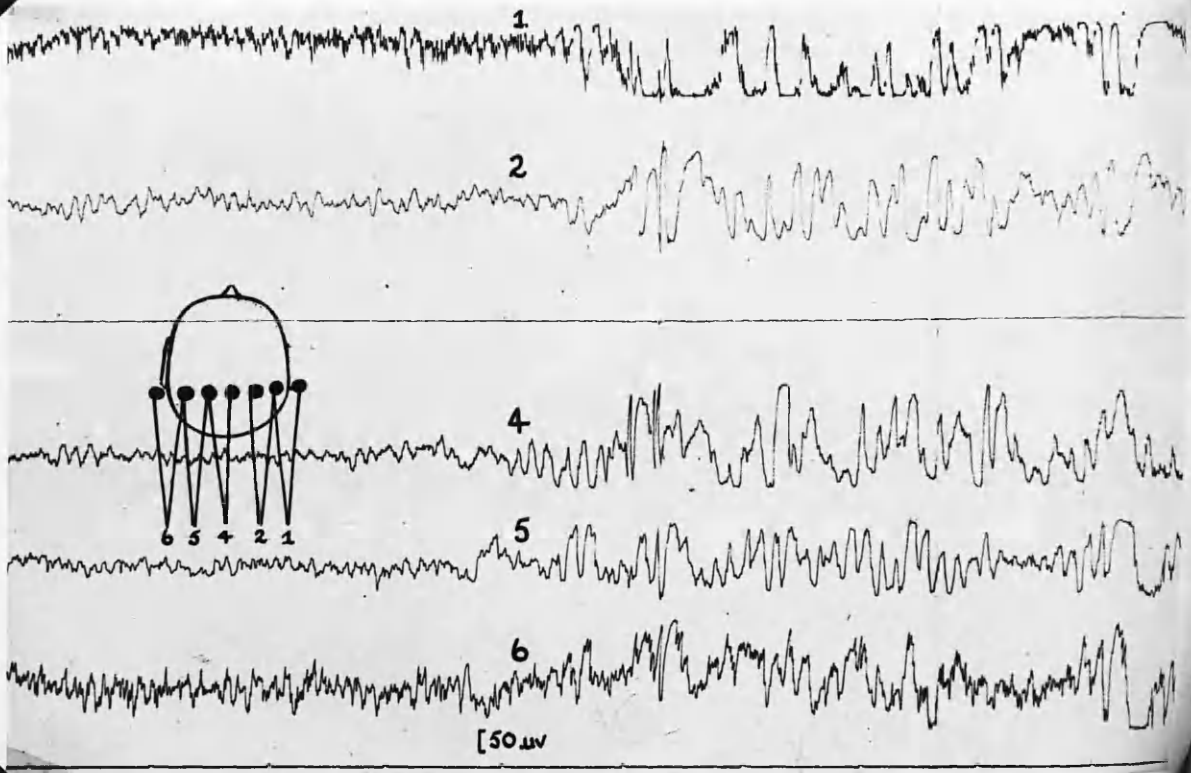
Previous personality: She was a rather immature person, with few interests in life.

History of present illness: She described two types of attacks which began in adolescence and had occurred infrequently since then. There were (a) attacks of temporary disorientation, and (b) attacks in which she slipped gradually into a state of unconsciousness which lasted for some time. There was no history of tongue-biting or of incontinence. Recently, she had been discharged from prison to take a domestic post in a Church Army Hostel. The work was too much for her, she became extremely agitated and was admitted to hospital as an emergency.

On examination: There was no physical abnormality. She was a garrulous person who showed a marked tendency to project and blame others for her misfortunes.

Special investigations: EEG. - The resting record was normal. Photic stimulation produced no change, but the injection of 200 mgm. metrazol produced a discharge of bilaterally synchronous spike and wave activity at 3 cycles per second, which was followed by a major seizure.

Progress: A diagnosis of idiopathic epilepsy in an inadequate psychopath was made on these findings. She was treated with phenobarbitone and epanutin, but no marked change in her behaviour occurred. A job in a factory was found for her, but she was last heard of in January, 1951, when she was serving a sentence of three months at Manchester, having been found without visible means of support.



W.E.H:- Generalised spike discharge and onset of major seizure after injection of 240 mgm. metrazol.

Mr. W.E.H. (26) 20.3.50.

Reason for referral: Investigation of fits which began five years earlier.

Family history: His parents had frequent quarrels, and separated when he was seventeen years of age.

Personal history: He was a rather neurotic child, and was afraid of the dark. At the ages of five and six he had peritonitis and pneumonia, and from time to time he had fairly severe bilious attacks. His school record was a good one, and since leaving school he had been in the paper trade, apart from war service in Western Europe (1943-47).

Previous illness: In 1941, he became unconscious several hours after being struck on the head by a football. The unconsciousness lasted for two days. After the campaign in Holland, in 1947, he developed, and was treated for, neurasthenia, at an Army Psychiatric Hospital.

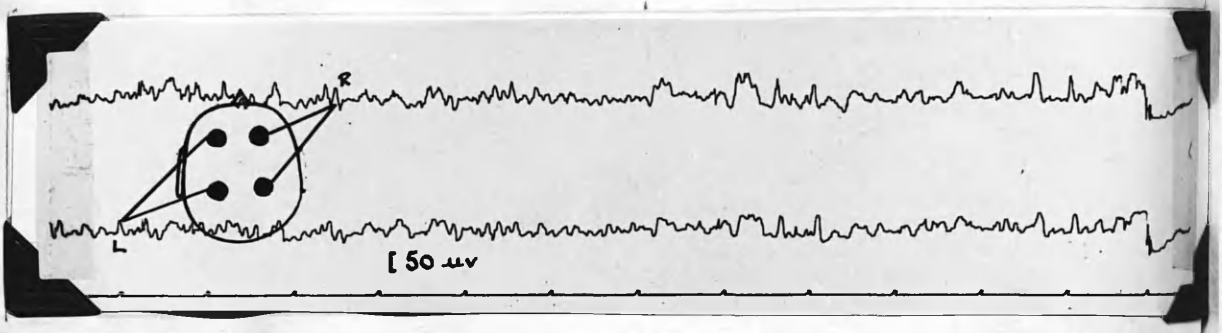
Previous personality: He was always a shy, rather narcissistic youth, who was a trifle hypochondriacal.

History of present illness: In 1945, he began to have peculiar attacks which were associated with a feeling of abdominal discomfort. Then he felt faint, and heard voices talking to him, but he had never been able to make out what was said. When these attacks occurred in the night, he had fallen out of bed. There was no true loss of consciousness, no tongue-biting and no incontinence.

On examination: Physical: He was found to be physically fit. Mental: A shy youth, who showed a great deal of anxiety. There was no evidence of deterioration or of thought disorder.

Special investigations: W.R.: Negative. Skull X-Ray: N.A.D. Intelligence: Wechsler I.Q. verbal 107, performance 113, full scale 111. Rhorschach: This showed a response suggestive of hysteria. EEG.: The resting record showed a focus of abnormal activity in the left temporal area. After photic stimulation there was no essential change, but the injection of 240 mgm. metrazol produced a major fit.

Progress: In view of the history and these findings, it was thought that he was suffering from psychomotor epilepsy arising from a temporal lobe focus which was related probably to the football injury in 1941. He was put on epanutin gr.1½ t.i.d. and was discharged from hospital on 1st April, 1950.



E.R.H:-Bilaterally synchronous slow activity after the injection of 180 mgm. metrazol.

N.B:- The six channel record showing possible frontal spike activity was too marred by artefact to be worth reproducing.

Mr. E.A.H. (50) 31.7.50.

Reason for referral: The investigation of fits which he had had for twenty-six years.

Family history: The patient's mother and a grand-uncle were said to have died in asylums.

Personal history: He was an illegitimate child, and was reared by foster parents. After school, he had had a variety of jobs as a labourer. He was married and had three children, one of whom had had a nervous breakdown. This was said to have been caused by the patient attacking her.

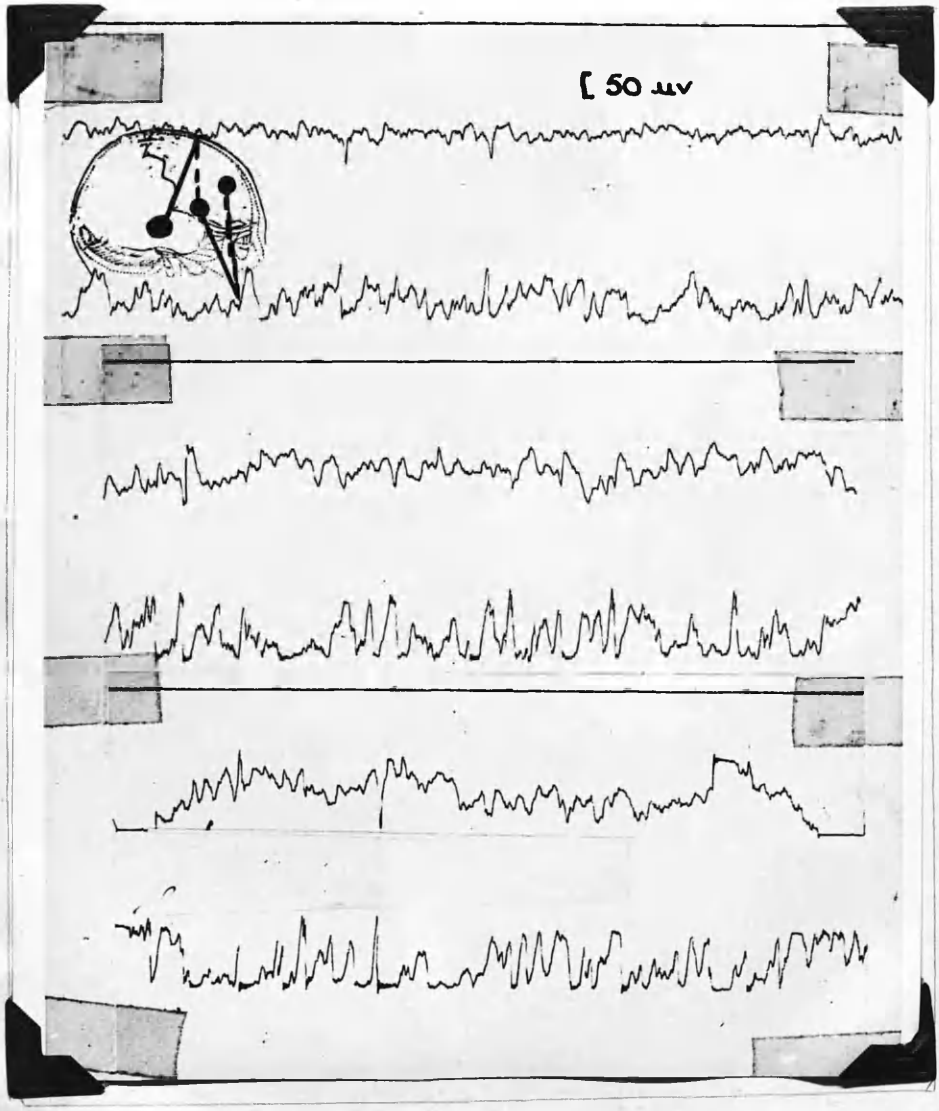
Previous personality: He had been a quiet, sensitive person.

History of present illness: At the age of twenty-four, he had had his first fit, and for the following two years the attacks occurred two to three times per week. Subsequently, they became less frequent, and at times he had remissions for as long as seven months. In recent years, the attacks had become more frequent. His personality had undergone a gradual deterioration. He had had frequent outbursts of temper, and had experienced suicidal ideas. On one occasion, he had attempted to strangle his wife, and he had attacked his daughters. In 1945, he had been admitted to an Observation Ward, following an outburst of violent behaviour. His major epileptic fits occurred by day, and he experienced an aura of epigastric discomfort. Then the fit began with flexion of the fingers of the left hand, and spread to the rest of the left upper limb and the remaining parts of the body in a major seizure. Tongue-biting and incontinence were uncommon.

On examination: There was impaired movement of the left arm, forearm and hand. The tendon reflexes were brisker in the left arm and leg than in the right. He showed evidence of deterioration of his memory and of his ability to concentrate.

Special investigations: W.R. - Negative. E.S.R., Serum bromide, blood examination and C.S.F. examination were all within normal limits. X-ray of skull showed no abnormality. Intelligence: Wechsler, Verbal I.Q. 69, Performance I.Q. 69, Full-scale I.Q. 65. There was no positive evidence of deterioration. EEG. - The resting record showed some sharp waves and some slow theta activity in the left frontal area. Photic stimulation produced no change, but the injection of 180 mgm. metrazol produced some bilaterally slow activity. The test was repeated and the injection of small doses of metrazol produced some small spikes on the inferior aspect of the right frontal lobe, but after 420 mgm. had been injected a major fit ensued, which was initiated by bilateral slow waves.

Progress: It was considered that he was suffering from epilepsy secondary to a focus in the right inferior frontal region. The attacks were treated with epanutin and phenobarbitone. He refused to have air studies.



Mr.D.H:-Initiation of a right frontal spike focus and a major seizure by the injection of 140 mgm. metrazol.

Mr. D.H. (42) 1.4.49.

Reason for referral: Investigation of fits which he had had for seventeen years.

Family history: No relevant information was available.

Personal history: His birth was normal, but he was a nervous child, shy and enuretic. He had a grammar school education, but was not very bright. His work record, as a travelling salesman, had been remarkably poor.

Previous personality: He was never a very successful person, and he tended to live in a fantasy world in which he was always a gentleman with expensive tastes.

History of present illness: When he was 25, he suddenly became jealous of his girl friend and attempted to murder her with a miniature pearl-handled revolver. He succeeded in wounding her, but not seriously. Subsequently, he attempted to kill himself, but the bullet did not penetrate far enough into the right frontal lobe. He was imprisoned, and three months after the incident he had his first epileptic fit in his sleep. The attacks, which were grand mal in type, continued regularly at two to four weekly intervals since then. They occurred chiefly in the night.

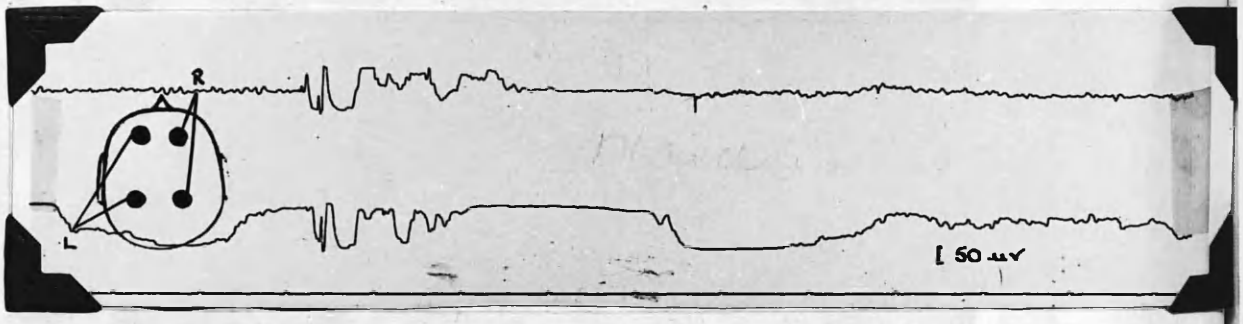
On examination: Physical: The tendon reflexes were more brisk on the left than on the right. Tone was increased in the left limbs. He had an extensor plantar response in the left foot. There was a scar with an underlying bony defect in the right frontal region. Mental: He showed garrulousness and a certain degree of circumlocution. There was no evidence of deterioration or of thought disorder.

Special investigations: W.R. - Negative. E.S.R. - 3 mm. Intelligence: I.Q. Wechsler, Verbal 102. Performance 100. EEG. - The resting record showed no specific abnormality. The use of photic stimulation and seconal produced no change. The injection of 140 mgm. metrazol produced a clearly-defined spike focus in the right frontal region. This was followed by a major fit. Skull X-Ray. Foreign body in the right frontal area.

Progress: He continued to have regular fits. These were observed to be Jacksonian in type, beginning in the left arm and spreading to involve the whole musculature. They were controlled to some extent by phenobarbitone and epanutin. In view of his poor general ability, arrangements were made for him to go to an epileptic colony. A diagnosis of Jacksonian epilepsy was made.

Mr.D.H:- Lateral view of foreign body in right frontal area.

Mr. D.H:- A.P. view of foreign body in right frontal area.



G.M.H:- Bilaterally synchronous spike and wave activity after injection of 340 mgm. metrazol.

Mrs. G.M.H. (23) 17.3.50.

Reason for referral: Investigation of fainting attacks which began about eighteen months earlier.

Family history: There was no relevant information.

Personal history: Her childhood was uneventful. At school, she was an average scholar, and during the previous nine years she had been employed fairly steadily in factory work. At the age of twenty-one, she had married a man somewhat older than herself. Four months after marriage, she was distressed to find herself pregnant. Since then, she had had no sexual relations with her husband since she believed he had a venereal disease, although he denied this. After the birth of the child, it was sent to the care of another married sister of the patient, and the patient herself returned to work, although there was no financial hardship. The home situation was an unfortunate one in that she and her husband shared a home with her family, who had little time for her husband.

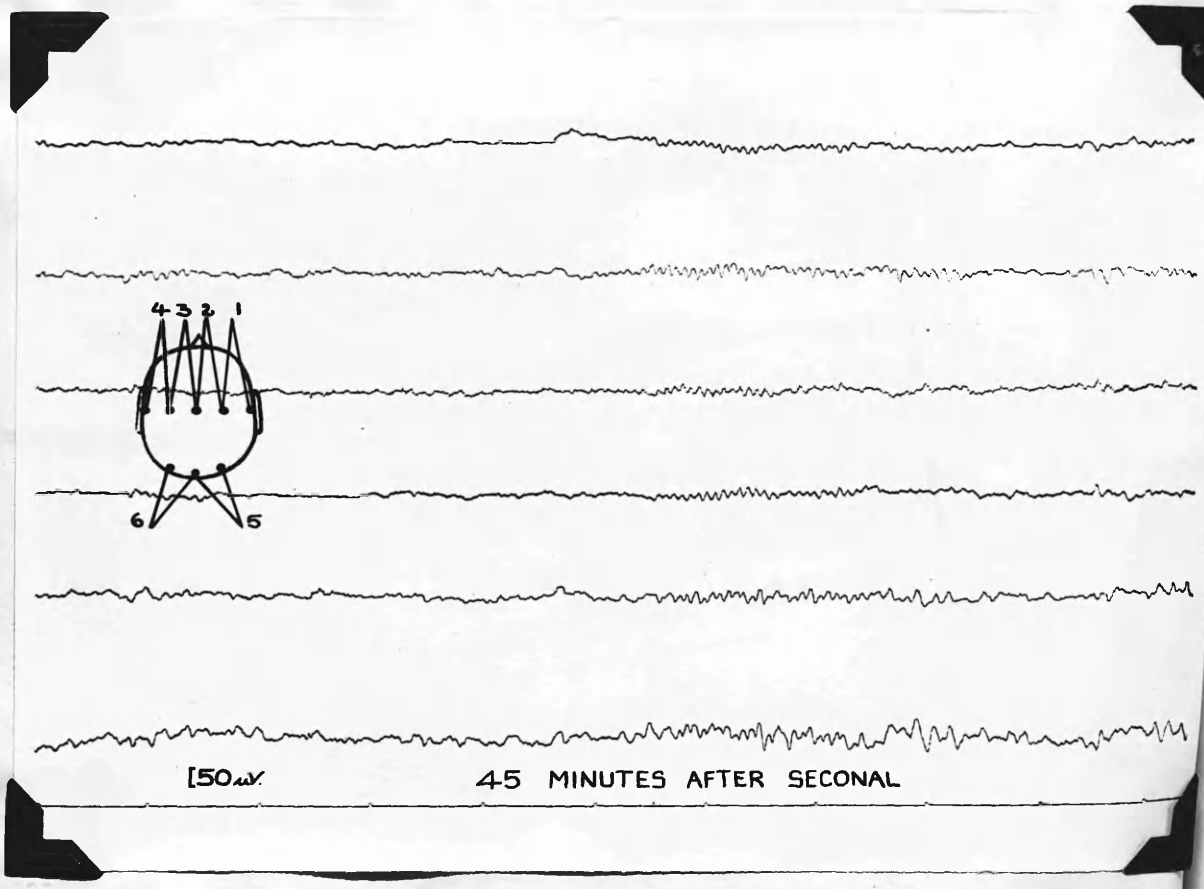
Previous health: At the age of sixteen, she had a fainting attack while walking in the street. There had been no recurrence of this.

History of present illness: Eighteen months ago, during her pregnancy, she began to have fainting attacks in which she fell down without any warning. Frequently, she injured herself in her fall, but at no time was she incontinent, nor did she bite her tongue. The attacks occurred once or twice per week, and in a recent one she had sustained a fairly severe burn.

On examination: There was no physical abnormality of note.
Mental: She was rather tense and anxious. There was no evidence of deterioration.

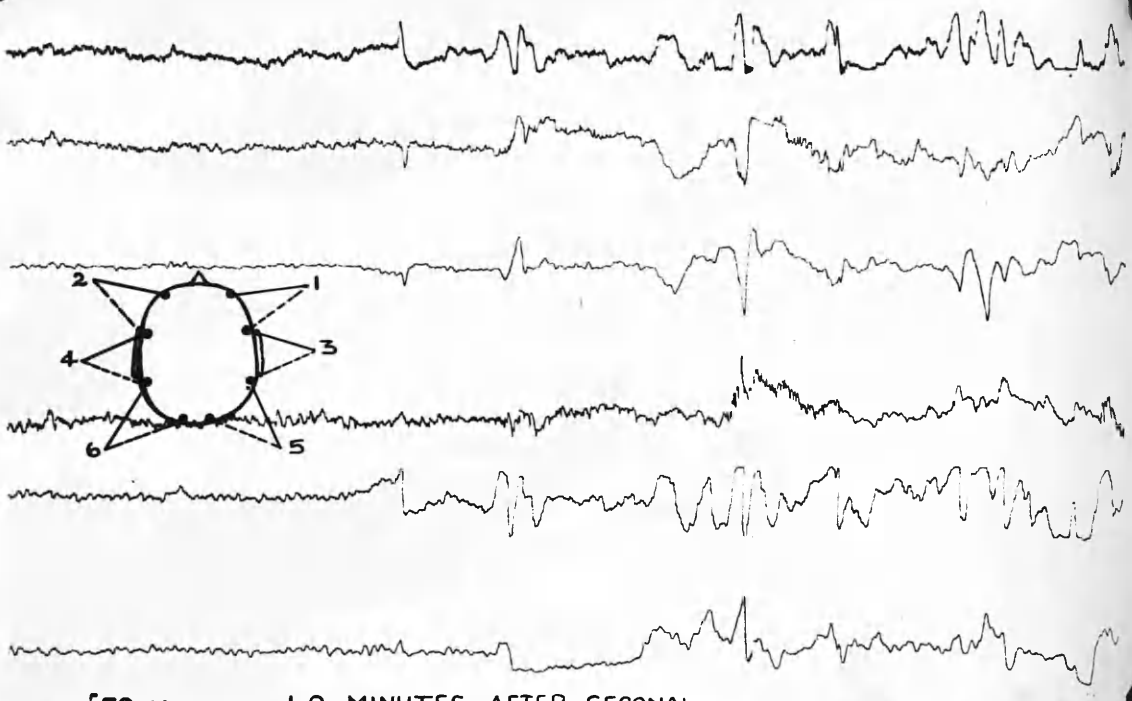
Special investigations: Skull X-Ray - Normal. EEG. - The resting record showed some central slow theta activity, but was otherwise normal. Photic stimulation produced no specific change, but the injection of 340 mgm. metrazol in divided doses evoked a single burst of bilaterally synchronous spike and wave activity, which was considered to be diagnostic of idiopathic epilepsy.

Progress: The diagnosis of idiopathic epilepsy having been made, treatment with epanutin and amphetamine sulphate was begun on 26th April, 1950. However, she failed to re-attend, and nothing further was noted about her.

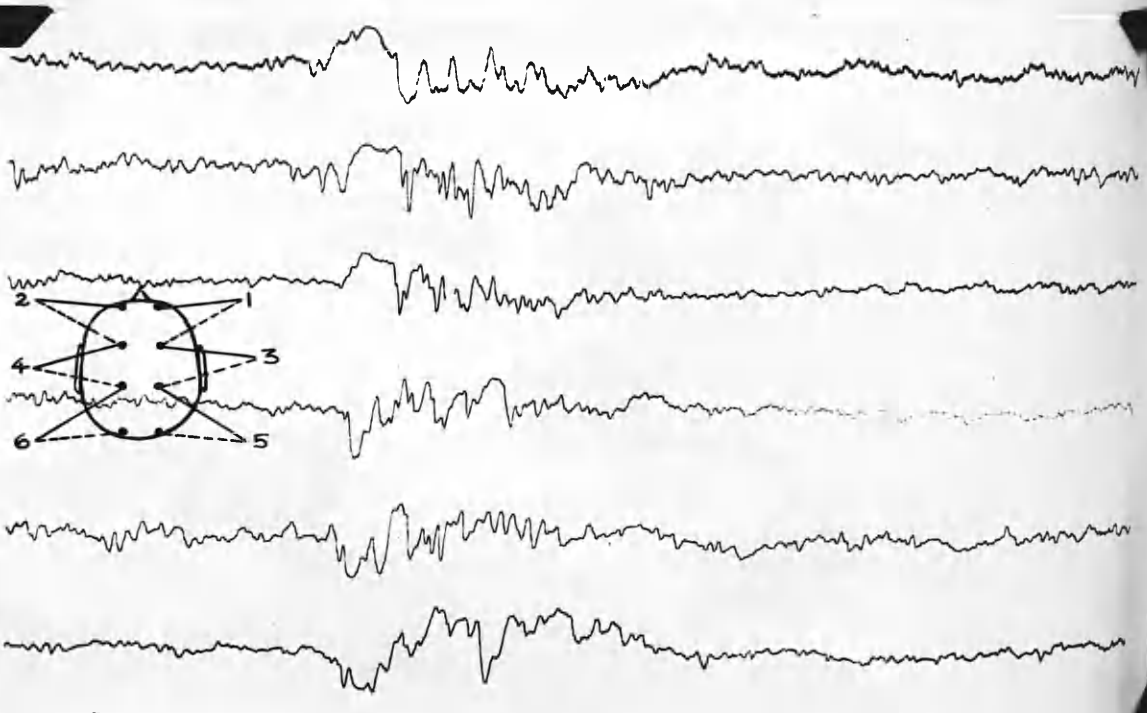


Typical sleep record following oral Seconal

The next patient to be described (Miss M.E.J.) had a major seizure following the use of oral seconal.By way of contrast,there is shown,on the opposite page, a record of sleep in a normal person who had been given oral seconal.



M.E.J.:- Attack of status epilepticus:- Onset of separate seizures after oral Seconal.



Miss M.E.J. (21) 8.12.49.

Reason for referral: The investigation of a fit which she had had one month earlier.

Family history: One of her cousins died at the age of twelve in status epilepticus.

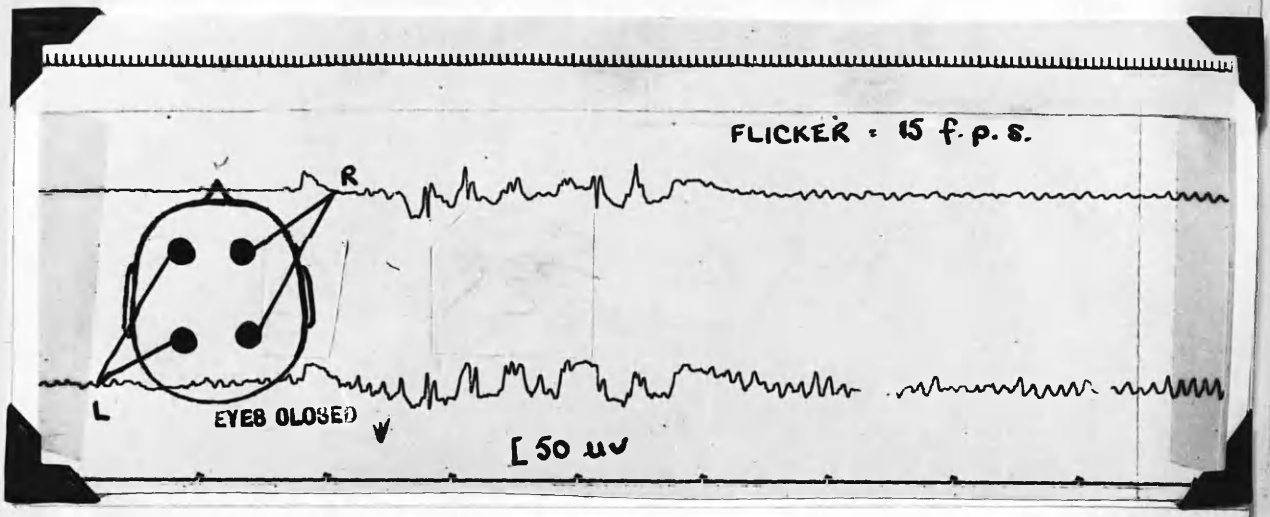
Personal history: She was an illegitimate child, and little was known about her early life. At school she was backward and subsequently she was unable to earn her own living. Then she was found to have a mental age of seven years, and was ascertained as a defective person. At the age of eighteen, she had an illegitimate child, and subsequently she was admitted to Darenth Mental Defective Hospital.

History of present illness: Occasionally, she was allowed out on parole, and in November, 1949, while at home, she was said to have had a seizure in which she lost consciousness. She was sent up to the Maudsley Hospital for investigation. On her first visit she proved too restless for a proper EEG. examination to be made. She returned the following week, and was given seconal gr. 3, orally, to sedate her and to allow an artefact free record to be obtained. About 25 minutes later, she went into status epilepticus, and had six automatisms in only one of which did clonic movements occur. In the course of these attacks, she was incontinent. The fits were aborted by Phenobarbitonum Solubile gr. 9, and she was then admitted to the wards where she had further seizures that evening, and four on the following morning.

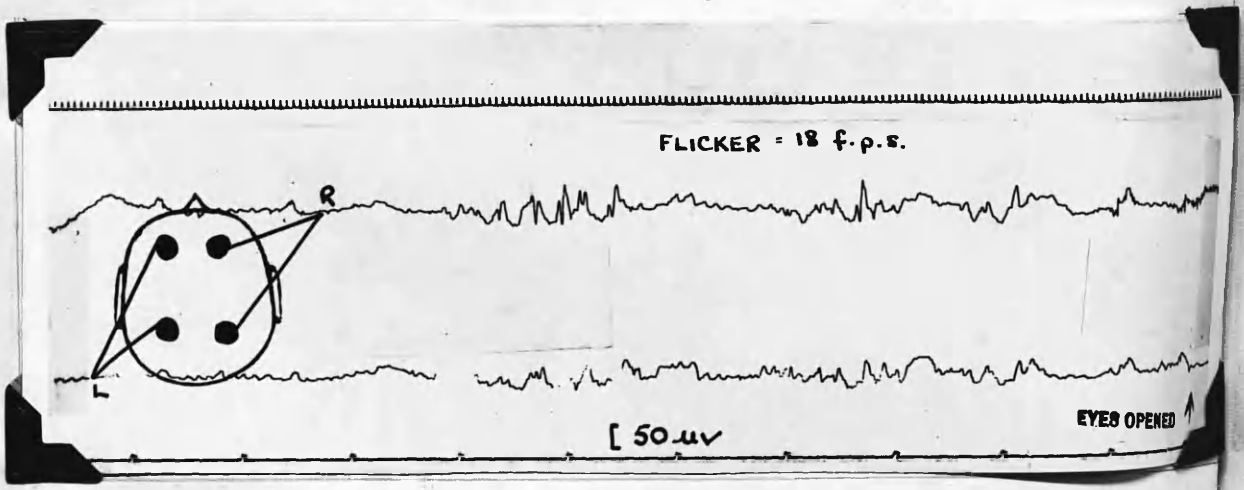
On examination: There was no physical abnormality of note. She was excited and proved difficult to examine, but she appeared to be defective in intelligence.

Special investigations: EEG. This showed, during the seizures, generalised high voltage slow waves at two to four cycles per second, with occasional spikes.

Progress: After her fits had ceased, she was stabilised on epanutin and phenobarbitone, and was discharged back to Darenth Hospital with a diagnosis of idiopathic epilepsy characterised by automatisms.



N.J.(a):- Bilaterally synchronous atypical spike and wave activity produced by photic stimulation at 15 flashes per second after the injection of 400 mgm. metrazol.



N.J.(b):- Bilaterally synchronous spike and wave activity (atypical) produced by photic stimulation at 18 flashes per second after the injection of 400 mgm. metrazol.

Miss N.J. (19) 19.1.50.

Reason for referral: She complained of attacks of jerking which she had had for four years.

No information was obtained about her family history or her early life.

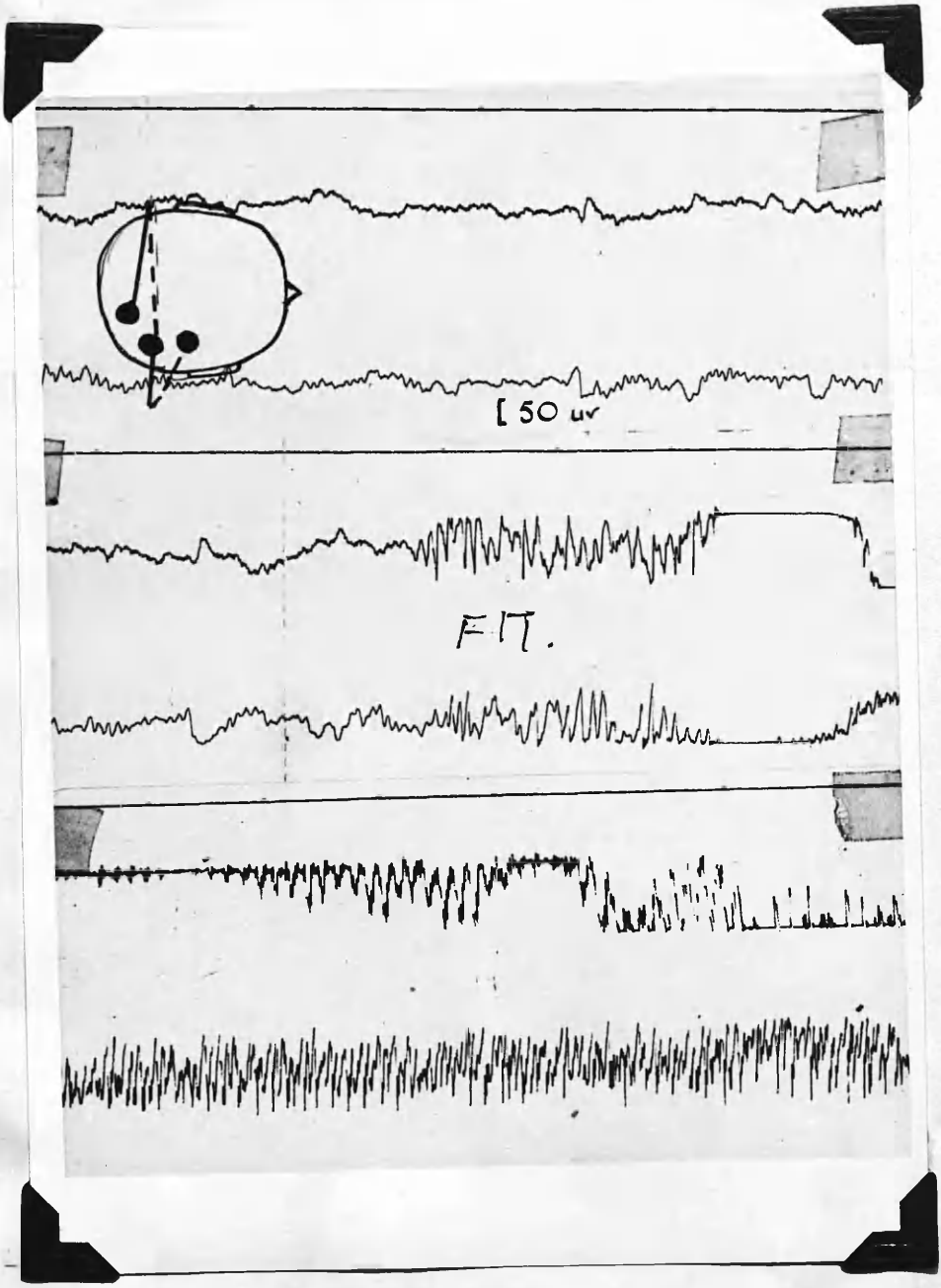
Description of illness: The jerking movements of which she complained occurred only in the forenoon. In these attacks, she frequently dropped objects and spilled her tea. In the past she had fainted only twice. The first fainting attack occurred at school, and she could remember shaking very violently before losing consciousness. The second attack had occurred two days prior to her visit to hospital. In it she bit her tongue and was dazed for half-an-hour afterwards.

No abnormal physical signs were noted.

Special investigations:

The skull x-ray and a full blood count showed no abnormality. EEG. - The resting record showed alpha activity and some fast Beta activity as well. Photic stimulation at eighteen flashes per second produced a single sharp wave followed by a slow wave. The injection of 400 mgm. of metrazol produced a burst of spike and wave activity which was abolished by eye opening. It re-appeared with closing the eyes and also with photic stimulation at fifteen and eighteen flashes per second. Each appearance of spike and wave activity was accompanied by a generalised jerking movement. These appearances were considered to be epileptic in nature.

Progress: She was considered to be suffering from idiopathic epilepsy, and was treated with phenobarbitone. When seen last in November, 1950, she had had two further attacks associated with loss of consciousness, but was otherwise well.



E.L:-Right occipital focal spike discharge during major seizure after oral Seconal.

Miss E. L. (27) 9.3.49.

Reason for referral: The investigation of epileptic fits which she had had since the age of eight.

Family history: One brother suffered from fits which began in middle life.

Personal history: She was born after a difficult and prolonged labour. Her mother died a few months later, and the patient was brought up by an aunt. In childhood, she had temper tantrums. She was educated privately to the age of sixteen. Subsequently, she did little work, some jobbing gardening and recently office work at the Girl Guides' Headquarters, but she had to give this up because of her fits. Her only severe illnesses have been due to falls on her head in 1946 and in March, 1949.

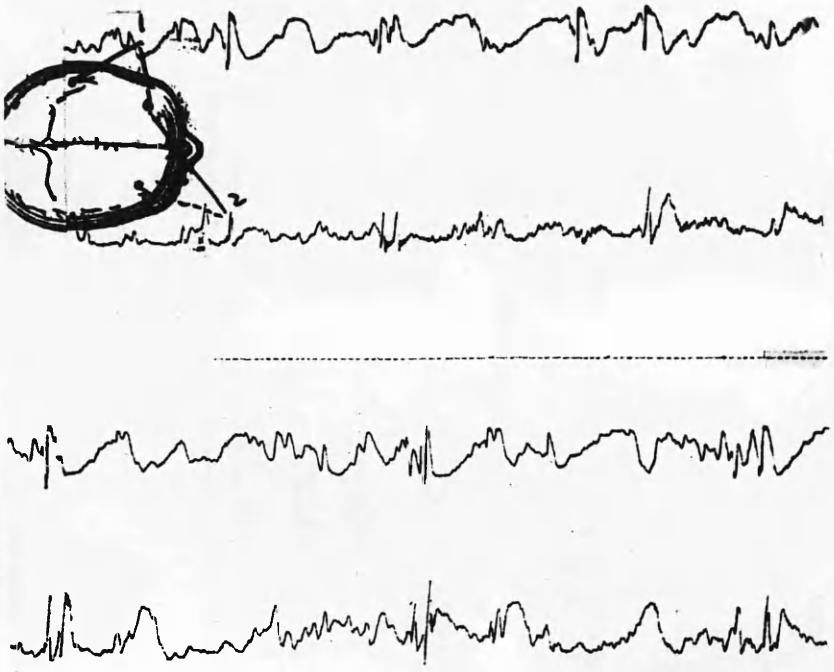
Previous personality: She was a shy, solitary girl, noted for her bad temper.

History of present illness: Her fits began at the age of eight. In these, she had an aura consisting of a pain in her head. She fell down on the floor. These ceased at the age of ten, but recommenced at sixteen, then, in a fit, she felt dizzy. To begin with, she did not lose consciousness, but soon loss of awareness of her environment ensued. There was no aura in these attacks, nor incontinence or tongue-biting. The attacks occurred daily. In May, 1948, she began to have psychological treatment from a curate, who found her a difficult problem and passed her on to another lay therapist. These treatments did not help her. On 1st March, 1949, she fell and injured the back of her head. Since then the frequency and severity of the attacks had increased, and she was having three to five fits daily.

On examination: There was evidence of scalp injuries in both occipito parietal regions. Her behaviour, apart from her fits, was normal.

Special investigations: EEG. The resting record showed a spike focus in the right occipital region. Photic stimulation produced no change, but seconal gr.3, initiated generalised spike discharges.

Progress: She was observed to have characteristic grand mal fits, characterised by tonic spasm followed by myoclonic jerking of the muscles. These were controlled in time by a combination of phenobarbitone and epanutin. A diagnosis of idiopathic epilepsy was made. Attempts were made to help her find suitable employment, but after she had tried several jobs of a domestic nature, she gave up the attempt, and entered a mental hospital as a voluntary patient.



G.A.L:- Left frontal spike focus seen during insulin hypoglycaemia.

Reason for referral: A complaint of thinking that everything he saw and heard was against him. This was of recent origin.

Family history: There was no relevant information.

Personal history: He was born in Germany, where he had a normal upbringing. As a Jew, he suffered some persecution, but he came to England in 1939 and was educated at elementary and technical schools. He worked as a chef since the age of sixteen, but he had many changes of job because difficulties had arisen between him and other members of the staff. Since going to work, he had had a fairly lengthy series of homosexual relationships.

Previous illnesses: In 1938 he had a head injury with concussion. In 1941, he began to have occasional attacks in the night, which were probably epileptic in nature. After an attack in 1945, he entered St. George's Hospital and had a tantalum plate put in to cover a defect in the frontal bone. Since then the attacks continued at fairly infrequent intervals.

History of present illness: He became depressed in 1946 when he was possessed by morbid thoughts for about five months, and experienced a feeling of hopelessness. In late 1947, he attended the Tavistock Clinic where he sought treatment for his homosexuality. By November, 1948, he had become depressed once more, and imagined that people were talking about him behind his back.

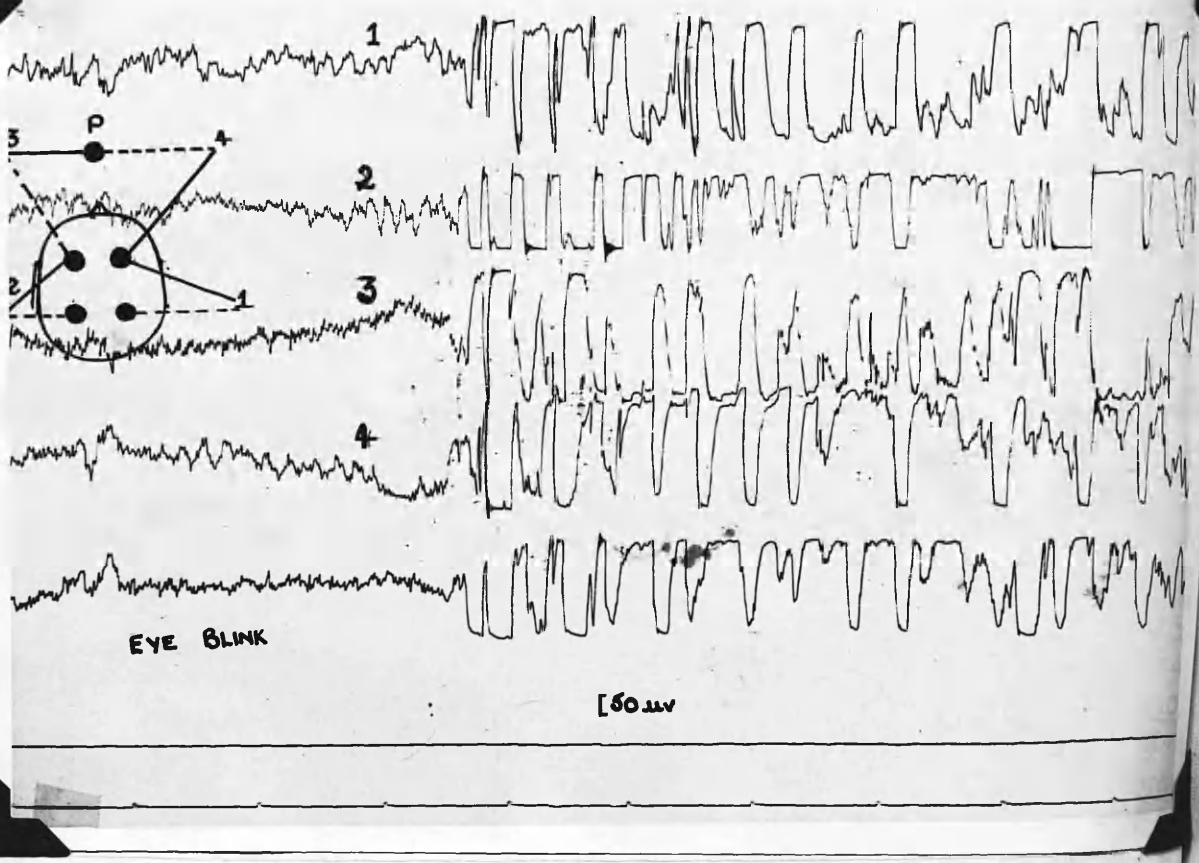
On examination: Physical : He had a diffuse thyroid gland enlargement, and in the right frontal region there was a scar beneath which a tantalum plate was palpable. There was no other abnormality: Mental: A quiet, preoccupied young man, who talked in a rambling fashion. He was moderately depressed, and believed that people were talking about him behind his back.

Special investigations: W.R. - Negative. E.S.R. and Serum Bromide were within normal limits. Intelligence: Wechsler, full-scale I.Q. 110, Matrices I.Q. 102. Goldstein Scheerer Test - There was some evidence of organic impairment. EEG. - The resting record was normal, but on examination in insulin coma a spike focus was shown on the left side.

Progress: He was given insulin coma therapy in the course of which he had spontaneous convulsions. After these, he made a marked improvement and recovered fully from his depression.

A diagnosis was made of schizo-affective psychosis in a person suffering from post-traumatic epilepsy.

He was last heard of in October, 1950, when he was in the hospital of H.M. Prison, Canterbury, but no details of his reason for being there were available.



W.McC:- Initiation of generalised seizure following injection of 200 mgm. metrazol. P = pharyngeal electrode.

Master W.McC. (14) 14.4.50.

Reason for referral: Delinquent behaviour after a head injury in July, 1949.

Family history: His father had a long history of prison sentences for larceny, etc. The mother was a highly-strung woman, who had once tried to kill her children and herself by gassing when the patient's delinquent behaviour was at a peak. The maternal grandmother was an alcoholic.

Personal history: He was an overactive, bad-tempered child. On two occasions, he had rheumatic fever. He was backward at school where he was ostracised by the other boys.

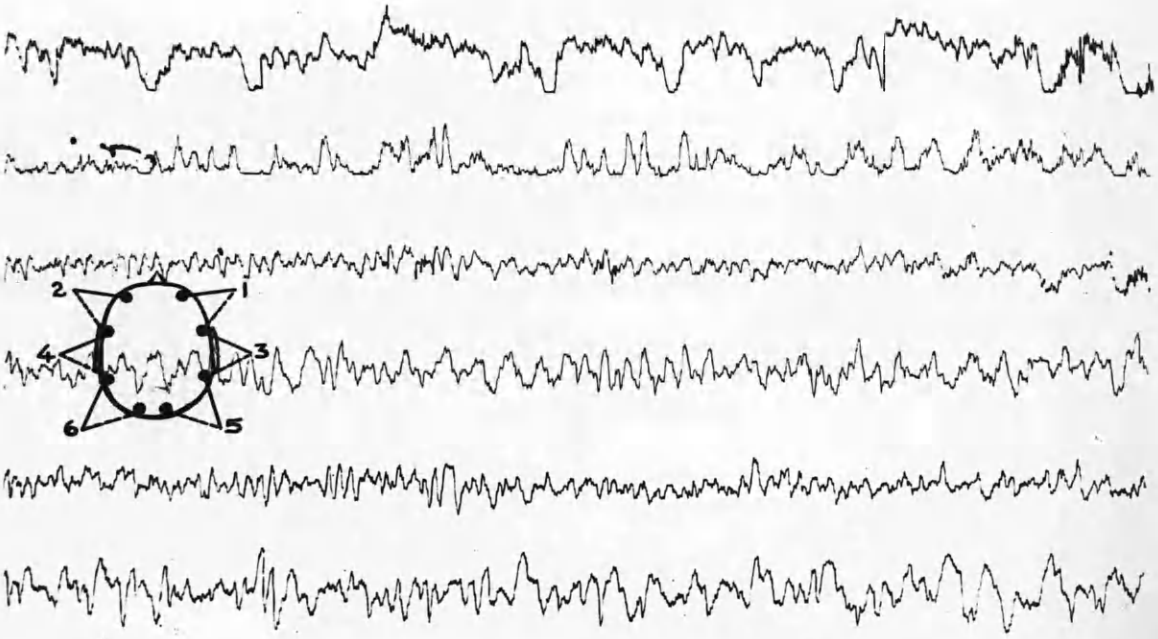
Previous personality: He had a long history of petty larceny; he was a dare devil, and was afraid of nothing.

History of present illness: In July, 1949, he fell from a tree and was unconscious. Ligation of the left middle meningeal artery was carried out at the London Hospital. He improved slowly, but three weeks after the injury he was considered to be in akinetic stupor. Then his behaviour became more violent, and six weeks after the operation he was incontinent in the middle of the ward and assaulted the staff. It was noted then that he spoke like a baby and had frequent temper tantrums. These became less frequent, but he began to smoke up to forty cigarettes per day; he stole his parents' cigarettes, got up in the night, lit the fire and sat smoking before it. His parents charged him as being beyond control, and he was sent to the Remand Home, whence he came to the Maudsley Hospital. It was thought that an air-encephalogram might be of value, and he was transferred to the Maida Vale Hospital for Nervous Diseases. Unfortunately, his father refused permission for investigations there, and he was re-admitted to the Maudsley.

On examination: There was no physical abnormality, and he appeared to be a friendly, cheerful boy.

Special investigations: Intelligence: Binet I.Q. - 73. EEG. - The resting record showed an excessive amount of fast Beta activity. Photic stimulation produced no change, but the injection of 200 mgm. metrazol produced a major fit with cortical spikes followed by slow waves. W.R. - Negative. B.S.R. and Serum Bromide were within normal limits. Skull X-Ray showed a post-operative bone defect.

Progress: During his stay in hospital, the patient had several attacks characterised by falling to the floor, without loss of consciousness. He had photophobia and a tachycardia. These attacks were considered to be di-encephalic in type. They did not respond to anti-convulsant medication. Arrangements were made for him to have coaching at his local school. He was heard of last in May, 1951, when he had been sent to an approved school after being sentenced for housebreaking and larceny.



J.M.:- Onset of major seizure discharge in left hemisphere following injection of 360 mgm. metrazol.

Mr. J.M. (31) 8.5.50.

Reason for referral: The investigation of fits which he had had for seven years.

Personal history: At the age of five, he had a severe attack of measles and was hyper-pyrexial for three weeks, after which he became deaf. At school, he proved to be backward, and subsequently he worked as a railway porter, but latterly he had had trouble in keeping his jobs because of his fits.

Previous illness: Twelve years earlier, he had had an attack of excitement in which he imagined that he was the head of the world, and he heard voices telling him what to do and where to go. This cleared up after six weeks in Netherne Mental Hospital.

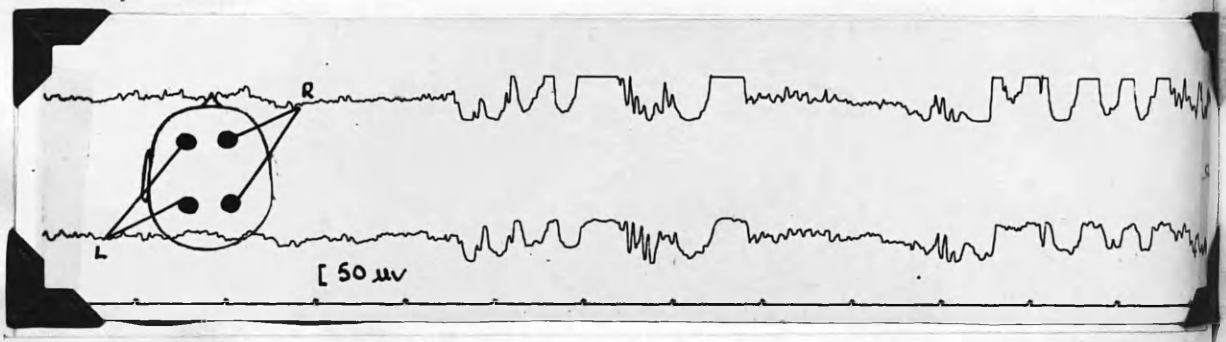
Previous personality: He had been a sociable individual of good personality.

History of present illness: Since the age of twenty-four, he had been having two epileptic fits each month. In the attack, his right arm and right leg shook for two seconds, giving him time to lie down and put a stick between his teeth with his left hand. Occasionally, he bit his tongue, but he was never incontinent. After the attack, he was dazed and had a headache for half-an-hour. He also had some weakness of the right hand and leg, and found it difficult to speak. Shortly after the attacks began, he was put on luminal gr.½ b.d. and for fourteen months he had no fits, although they began again in March, 1950.

On examination: There was no physical abnormality, but he showed some emotional blunting, and appeared to be below average in intelligence.

Special investigations: W.R. - Negative. Skull X-ray - Normal Intelligence: Matrices I.Q. - 84. EEG. - The resting record showed a few doubtful slow waves in the left central area. Photic stimulation produced no change. The injection of 360 mgm. metrazol initiated a major seizure which began with the appearance of spike activity in the left central area, and continued as a bilateral spike discharge after thirty seconds. Twitching of the right hand occurred before the fit became generalised.

Progress: He was considered to be suffering from symptomatic epilepsy, which was secondary to a left cortical focus. It was thought possible that this might have been an after-effect of the pyrexial illness he had had in childhood, which may well have been a measles encephalitis. Treatment with epanutin and phenobarbitone was begun, and employment was found for him, but he continued to have attacks and to lose his jobs from time to time.



J.M:- Onset of major seizure after injection of 360 mgm. metrazol.

Miss J.M. (26) 8.5.50.

Reason for referral: The treatment of fits which she had had since the age of fifteen.

Family history: The father was a highly-strung person, and the mother had had a nervous breakdown at the age of twenty-four.

Personal history: She was born in Egypt. Apart from frequent temper tantrums, her early life was normal. Her school career finished at the age of fifteen by reason of the onset of her fits. Since the age of eighteen she had worked as a secretary.

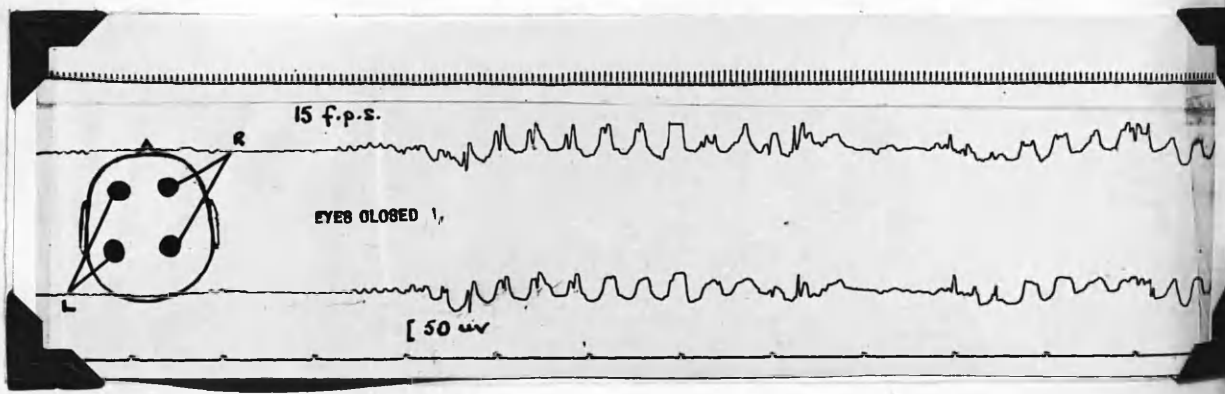
Previous personality: She had always been an active, cheerful girl who was conscientious in her work.

History of present illness: Her first attack occurred when she was at school. She felt all worked up inside, then she had a fit in which she bit her tongue, fell down and was unconscious, but not incontinent. Subsequently, she had frequent fits, as many as three in one day, and her family doctor treated her with anti-convulsants. The attacks became less frequent, and she went for several years without having a fit. Her last attack had been in October, 1948, and the one before that had been eighteen months earlier. She was now anxious to take out a driving licence.

On examination: There was no physical abnormality, and she appeared to be free from neurotic symptoms.

Special investigations: X-Ray of Skull and of muscles showed no abnormality. EEG. - The resting record showed a normal dominant alpha rhythm. Photic stimulation produced no change, but the injection of 360 mgm. metrazol over a period of two minutes produced a burst of bilaterally synchronous spike and wave activity at three cycles per second, which was followed by a major seizure. Seconal produced no change.

Progress: The active investigations detailed above were undertaken in view of the infrequent nature of the attacks, and also by reason of the normality of the resting record. The diagnosis of epilepsy having been confirmed, treatment with epanutin and phenobarbitone was continued. Her attacks remained well-controlled.



J.P.) - Bilaterally synchronous spike and wave activity on combining eye closure with photic stimulation at I8 flashes per second.

Reason for referral: The investigation of fits which had begun in July, 1947.

Family history: This was not relevant.

Personal history: There was no untoward event in his early life. At school he had had an average career, and was considered to be a fairly healthy boy prior to the onset of his present illness.

History of present illness: In July, 1947, he had had his tonsils and adenoids removed on the advice of the school doctor. A day or two after this, he began to have attacks in which he went blank for a moment or two, but he did not fall down. After an attack, he went into a deep sleep. Twelve of these attacks occurred in the course of one month, then he was seen by his private doctor, who put him on phenobarbitone, gr.½ twice daily. To his parents' eyes, this regime appeared to stop the attacks, but they continued at school. His teachers complained that he was aggressive and bad-tempered after an attack, and felt that more active treatment was indicated. He was then referred to the Maudsley Child Guidance Clinic.

On examination: There was no physical abnormality, and he appeared to be a jolly, cheerful boy who was rather more than well cared for by his mother.

Special investigations: Intelligence, I.Q. Binet 106. EEG.- The resting record showed no epileptic features.

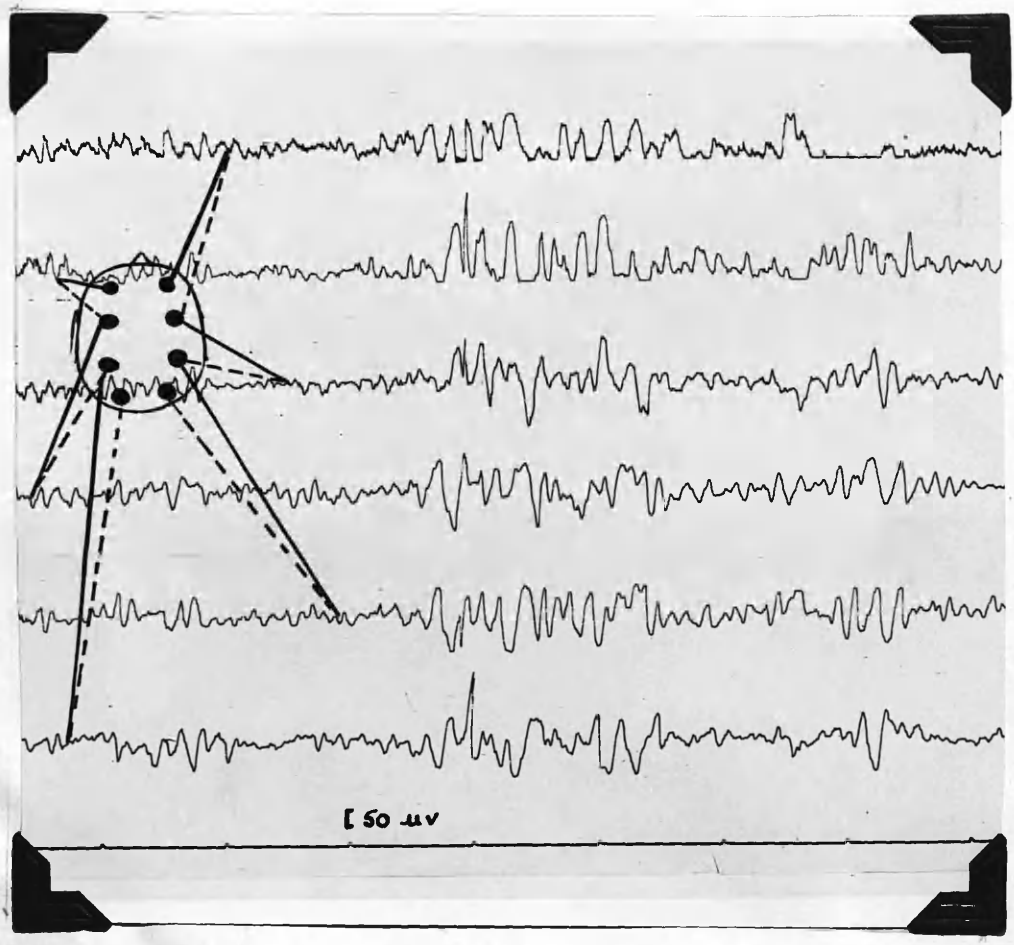
Progress: In view of the fairly classical form of his attacks, it was considered that he was suffering from minor epilepsy, and he was kept on the original dosage of phenobarbitone.

In February, 1950, he began to have attacks in which his limbs twitched violently, and in which he fell to the ground.

Further special investigation: The resting EEG. was again normal, but photic stimulation evoked a discharge of bilaterally synchronous spike and wave activity. Seconal produced no change.

Further progress: In view of the now positive EEG. findings, and the occurrence of convulsive movements, he was treated by a combination of epanutin and phenobarbitone. His attacks ceased once more, and when seen last in April, 1950, he was about to start work as a porter.

Final diagnosis: Idiopathic epilepsy.



C.P:- Bilateral spike discharge after injection of 300 mgm. metrazol.

Mr. C.P. (28) 22.11.49.

Reason for referral: The investigation of fits which he had had since the age of sixteen.

Family history: His father was an alcoholic, and an irritable man noted for his bad tempers. A paternal aunt was said to suffer from epilepsy.

Personal history: His early development was normal, and he had an average school career. Afterwards, he worked as a labourer, later as a lorry driver and recently as a telephone operator.

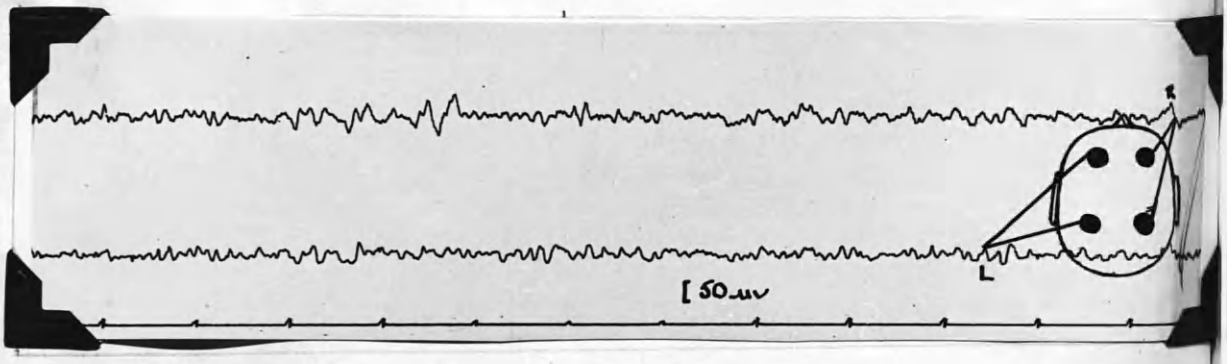
Previous personality: He was a rather solitary day-dreamer, who was ambitious for his own future.

History of present illness: Twelve years earlier, he had begun to have major epileptic fits as frequently as two to three times each week. After eight years of this, he was put on epanutin, which had stopped the major fits, but he noticed that he had attacks of difficulty in speaking or in understanding words. These occurred regularly, about twice per week.

On examination: There was no physical abnormality, but he had difficulty in finding words when he was excited.

Special investigations: W.R. - Negative. Intelligence: Matrices I.Q. 86. X-Ray of skull was normal. EEG. - The resting record was normal. Photic stimulation produced no change. Seconal, gr. 3, produced high voltage slow waves at 3 - 4 cycles per second. The intravenous injection of 300 mgm. metrazol produced bilateral spikes.

Progress: It was considered that the patient was obviously an epileptic, but that his present attacks might be due to anxiety occasioned by the stresses of a job which demanded a little more intelligence than he possessed. However, he was treated with a combination of epanutin and phenobarbitone, and nothing further was heard ofhim.



I.P:- Bilaterally synchronous slow activity after the injection of 350 mgm. metrazol.

Miss I.P. (32) 5.1.50.

Reason for referral: The investigation of fainting attacks which she had had for nine months.

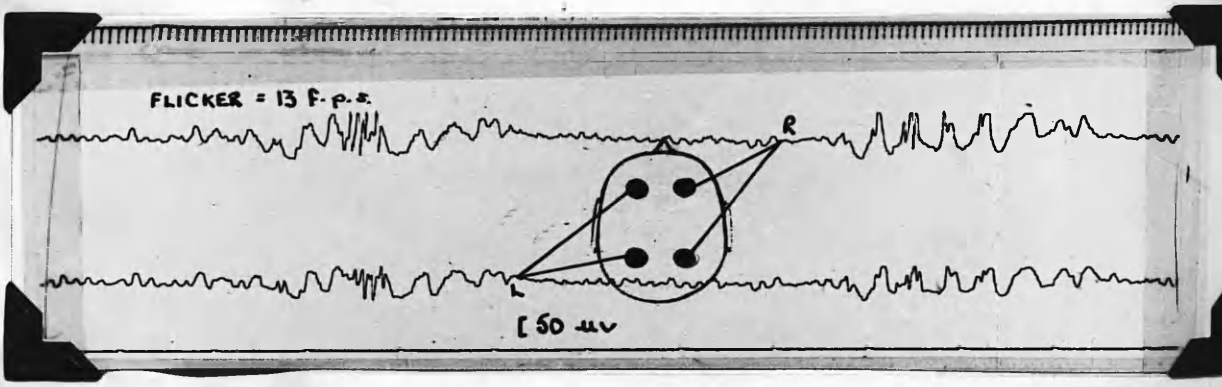
There was no relevant family history known.

Previous history: It was noted that she had had a thyroid-:ectomy in 1937, and that she had been invalided from the W.A.A.F. following a complaint of headaches in 1943.

Description of attacks: She had her first attack when washing-up after breakfast, when she had felt faint and had lain down on the floor. Her body felt cold and she shivered, but did not lose consciousness. The second attack occurred three months later, as she was cutting bread before breakfast. Then she fell suddenly and bit her tongue. Three similar attacks had occurred in the following six months.
There were no abnormal physical signs.

Special investigations: Skull X-ray was normal. EEG. - The resting record showed a dominant alpha rhythm, but some slow theta activity was also present. Photic stimulation produced no change, but the injection of 350 mgm. metrazol produced successive bursts of high voltage slow activity which was bilaterally synchronous in nature. These appearances were considered to be abnormal, but were not specifically epileptic in appearance. Seconal produced no change.

Progress: Clinically, she was considered to be suffering from idiopathic epilepsy, and she was given phenobarbitone. When seen in March, 1950, she had had no further attacks.



J.R:- Multiple spike and wave activity produced by photic stimulation at 13 flashes per second.

MISS J.E.R. (21) 14.3.50.

Reason for referral: A recent history of ataxia suggestive of an overdosage of epanutin.

Family history: A maternal uncle was said to have suffered from epilepsy; otherwise there was nothing relevant.

Personal history: Her birth and early development were normal, but she had many neurotic traits in childhood, including shyness and a fear of the dark. She attended a variety of schools from the age of five to nineteen, when she finally failed to take her Higher School Certificate. No work had been attempted since she left school - her parents had tended to over-protect her.

Sexual development: Menses began at age thirteen. Subsequently, she was seduced by her elder brother on two occasions. She had many sexual phantasies, which had given her a great amount of guilt.

Previous personality: A shy girl, who had very few friends outside the family circle.

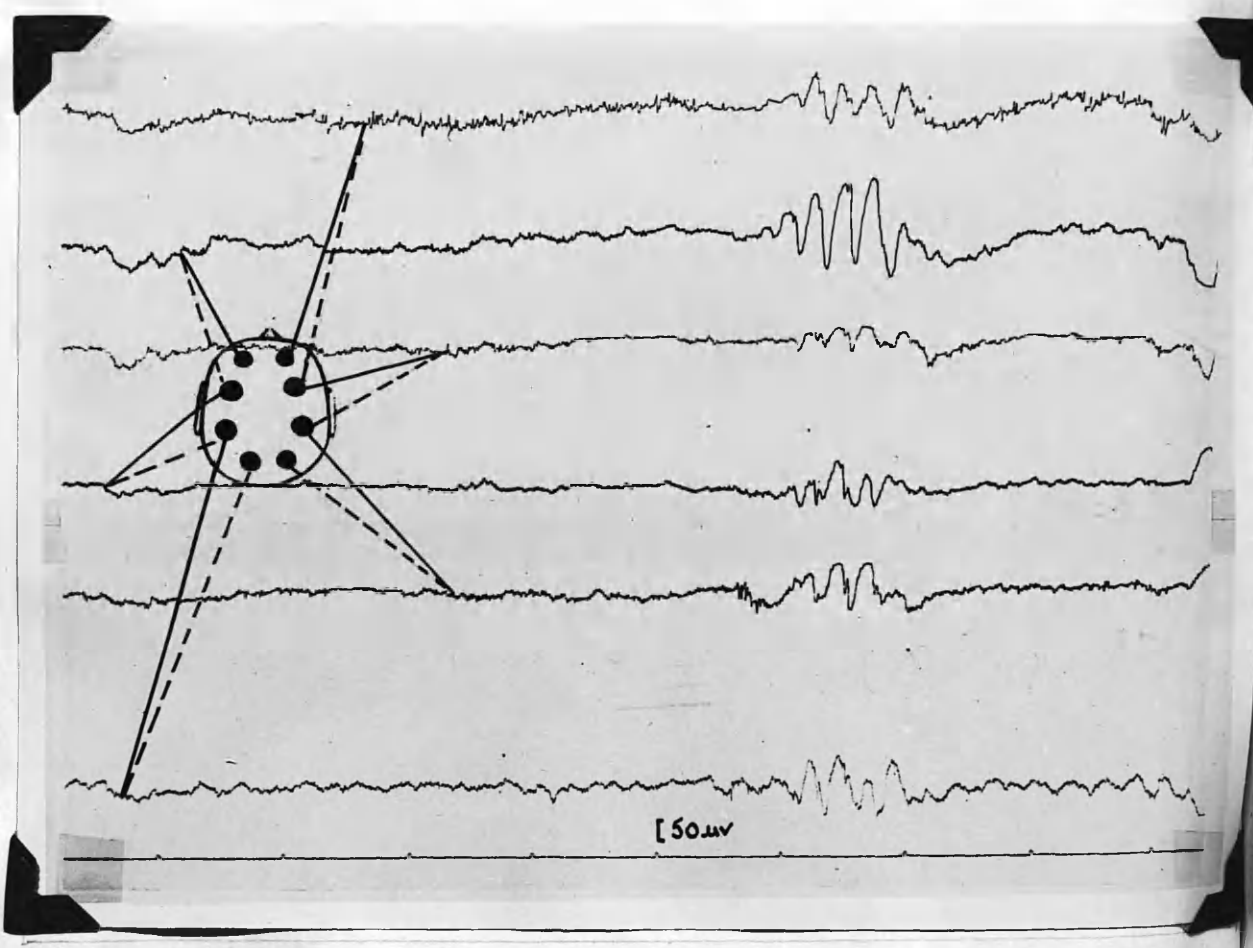
History of present illness: In 1940, she had a single fit. The attacks did not return until 1945, and since then she had had infrequent attacks by day. The attacks were of two types - in one she had no aura and fell suddenly to the ground. There were no muscular movements and she became cyanosed rapidly. At other times she had had attacks of myoclonic jerks only. On several occasions she had been incontinent. In 1945, she attended Chislehurst Child Guidance Clinic, and was put on phenobarbitone. Recently, she was seen by Dr. Denis Hill at King's College Hospital, where she was given small doses of epanutin. A few days prior to admission she complained that she could not see properly, could not stand up and could not sit up in bed.

On examination: Physical: She had a masculine hair distribution, but was otherwise normal. Mental: She showed a hysterical blandness of affect. Her symptoms were influenced by suggestion.

Special Investigations: W.R. - Negative. E.S.R. - 5 mm. Serum Bromide - less than 25 mgm. per cent. I.Q. Matrices 115, Mill Hill Vocabulary, 114. Wechsler, verbal 107, performance 87, full scale 97. Skull X-Ray - Normal. EEG. At rest, it was within normal limits, but on exposure to photic stimulation, numerous bursts of symmetrical spike and wave activity at 3 cycles per second appeared.

Further /

Further progress: There was no doubt that the girl was suffering from idiopathic epilepsy, but much of her behavious was hysterical in nature. The symptoms of ataxia disappeared soon after admission. Later, she revealed her sexual attachment to her brother, and her annoyance about his recent engagement. Her fits were controlled reasonably well by a combination of phenobarbitone and tridione. It was thought that she might be helped by psychotherapy, and it was arranged that this should be continued after her discharge from hospital.



J.A.R:-Bilaterally synchronous, atypical spike and wave discharge after the injection of 350 mgm. metrazol.

Mr. J.A.R. (36) Feb., 1950.

Reason for referral: The investigation of headaches and trembling attacks which he had had for ten years.

Personal history: His early life was uneventful, and on leaving school he obtained employment as a grinder, in which occupation he had remained. He married at the age of twenty-two, and had three children, all of whom attended the child guidance clinic regularly.

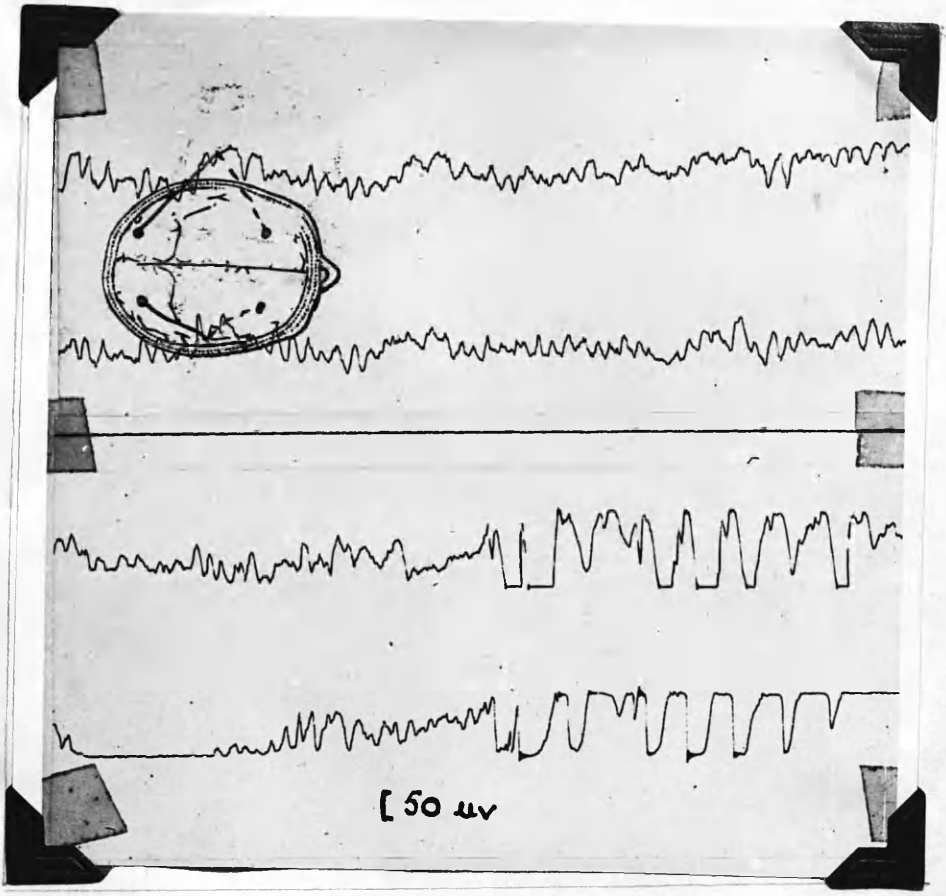
Previous personality: He appeared to have been a man who tended to be grossly over-anxious about his personal health.

History of present illness: Once a month for the previous ten years, he developed a headache which began always on a Monday. This headache continued and was associated with twitching movements of all the muscles of the body throughout the day. This combination continued usually until the Thursday. During all this time he felt extremely miserable and depressed. However, on the fourth day, he became rather aggressive, had a fight with his wife and then felt as "fit as a fiddle" for a further three to four weeks.

On examination: There was no physical abnormality, nor was there any evidence of mental deterioration.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record was a normal one, and photic stimulation produced no change, but the injection of 350 mgm. metrazol produced bursts of bilaterally synchronous spike and wave.

Progress: As a result of these investigations, he was considered to have an epileptic diathesis which caused him to have the attacks described above. He was treated with epamutin and amphetamine sulphate, but no change occurred in his condition. Subsequently, he was found to have had sexual intercourse with one of his daughters, and he received a term of imprisonment. When he was seen last, in February, 1953, there was no marked change in his behaviour, and the diagnosis was confirmed then as one of psychopathy.



J.R. :- Burst of bilaterally synchronous slow activity after the injection of 400 mgm. metrazol.

Mr. J.R. (20) 26.4.49.

Reason for referral: The investigation of fits which he had had since October, 1946.

Family history: His father suffered from fits in adolescence.

Personal history: His early life was uneventful, and after taking his school certificate at eighteen, he joined the Army but was invalided out by reason of his illness. Recently, he had been preparing for University entrance.

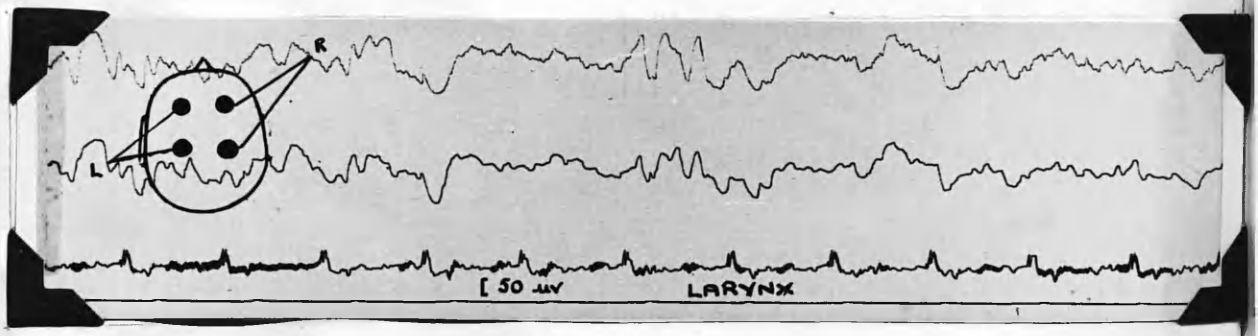
Previous personality: He was a shy, sensitive, solitary boy.

History of present illness: In October, 1947, while on parade, he had had a "blackout". Since then, these had recurred frequently. Just before the attacks developed, he felt dizzy, and then he dropped down in a dead faint. He recovered within a minute or two, however, without any memory of falling down. There was no history of tongue-biting, or of incontinence.

On examination: He was a tall, asthenic youth, B.P. 150/100. There was no mental abnormality.

Special investigations: W.R. - Negative. Skull X-ray - Normal. Intelligence: Wechsler full-scale I.Q. 123. EEG. - The resting record showed a fair amount of slow theta activity. Photic stimulation and seconal produced no change, but the injection of 400 mgm. metrazol induced some bilateral high-voltage slow delta activity.

Progress: These results were thought to be indicative of a diagnosis of epilepsy, which, from the nature of the attacks, was akinetic in type. During his stay in hospital, he had three attacks of the type described above in the course of ten days. Treatment with pheno-barbitone gr. ½ b.d. was begun. On this regime, he remained free from attacks, but a letter from a private doctor in October, 1950, indicated that, at that time, he had again had several fits.



E.R.S:- Continuous laughter recorded on laryngeal microphone as a myogram in association with generalised high voltage slow activity, after the injection of 200 mgm. metrazol.

Mr. E.R.S. (22) 28.6.49.

Reason for referral: The investigation of inexplicable attacks of laughter which he had had for seven months.

There was no relevant family history.

Personal history: His early life was uneventful. At school his work was not very good. He did not mix well with the other boys, and considered he was of a different clay to them. Subsequently, he worked as a motor mechanic, he served in the R.A.S.C. in the Far East without incident, and after demobilisation he obtained a position as a chauffeur.

Previous personality: He was a rather immature young man who had grown up imagining he was an American, and encouraging others to think so.

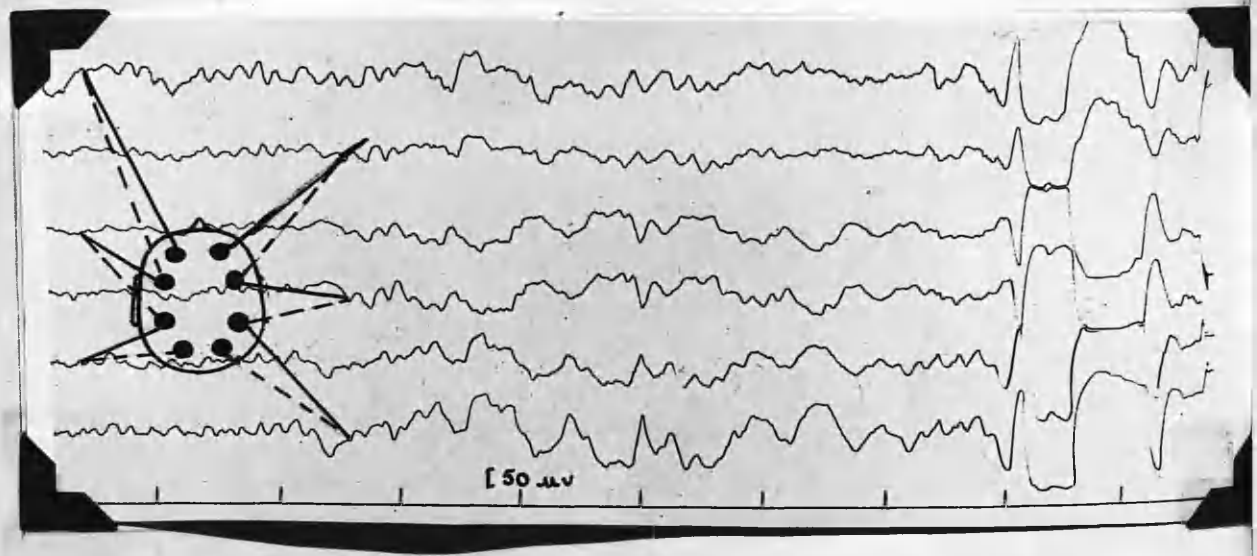
History of present illness: One evening in December, 1948, he had an attack of laughing, following which he was confused. Since then, these attacks had recurred, regularly, every two to three weeks. Often he was heard to be having an attack in his sleep, and he had no recollection of it on waking. One occurred while he was driving his employer, and he was reprimanded for insolence. Then he saw his doctor, who referred him to hospital.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. E.S.R., Serum Bromide and C.S.F. were all normal. X-Rays of skull and muscles showed no abnormality.

Intelligence: Wechsler full-scale I.Q., 99. EEG. - The resting record was within normal limits. Photic stimulation and seconal produced no change. The injection of 350 mgm. metrazol produced on one occasion a burst of spike activity and a major epileptic fit. A record was taken at another time, with a laryngeal microphone, in which the attacks of laughter were reproduced by frequent small injections of metrazol.

Progress: The patient was observed to have several attacks of laughter. These appeared to be epileptiform in type, in that the preceding smile appeared to be due to tonic spasm of the facial muscles. The succeeding "laughter" which was rather like coughing was due to clonic movements of the larynx. After such an attack, the patient was confused, and on physical examination he was found to have bilateral extensor plantor responses. No localising signs were found at any time. A diagnosis of idiopathic epilepsy was made, and his attacks were controlled by a combination of epanutin and phenobarbitone. He was advised to give up driving, and had no difficulty in finding work as a mechanic.



W.J.T:- Generalised burst of high voltage slow waves and onset of major seizure after the injection of 300 mgm. metrazol.

Mr. W.T. (18) 15.1.51.

Reason for referral: He complained of generalised headaches after a bicycle accident three months earlier.

Family history: His mother was an epileptic, and suffered from major seizures.

Personal history: His early life was uneventful, and he had suffered from no serious illness in the past.

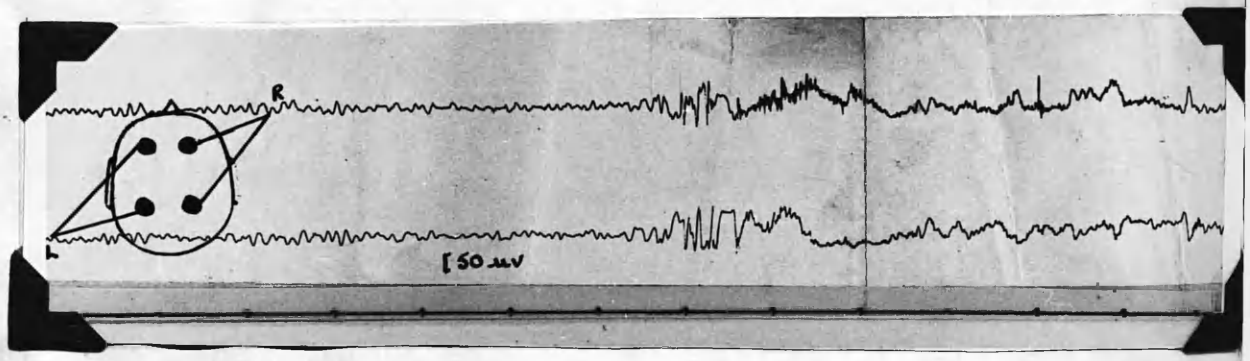
Previous personality: He was a rather shy, unassuming youth.

History of present illness: Two months earlier, he had fallen from his bicycle and injured his head. There was no good reason for the accident. He was dazed slightly after his fall, but at no time was he unconscious. One week after the accident, he began to have severe headaches, which commenced at the back of his head and spread forward. At times he experienced a humming noise in both ears, and he felt that he was going mad. Once he had blacked-out while standing. He felt as if the room was revolving, everything had blurred and he knew no more until next morning.

On examination: There was no physical abnormality, but in view of the wealth of detail with which he described his symptoms, it was thought that these might well be hysterical in nature. He was below average in intelligence.

Special investigation: Skull X-ray was within normal limits. EEG. Resting record showed no specific abnormality. Photic stimulation produced no change, but after the injection of 300 mgm. metrazol, some generalised, slow activity at 6 c.p.s. appeared, and was followed by a major seizure.

Progress: It was now thought that he was suffering from idiopathic epilepsy, and it was likely that his first attack had been responsible for his fall from the bicycle. In spite of the fact that he was treated with epanutin and phenobarbitone in adequate doses, he continued to have regular attacks of brief lapses of consciousness several times per week.



A.G.W:- Bilateral spikes initiating major seizure after the injection of 240 mgm. metrazol.

Mr. A.G.W. (20) 28.6.49.

Reason for referral: The investigation of nocturnal fits which he had had for ten years.

There was no relevant family history.

Personal history: His early life was uneventful. He did well at preparatory and public schools, and subsequently took a degree in Commerce. During the war, he served in the Royal Marines, but was invalided out when he began to have fits. Recently, he was employed as a costing consultant. He had been married for three years, but had no children.

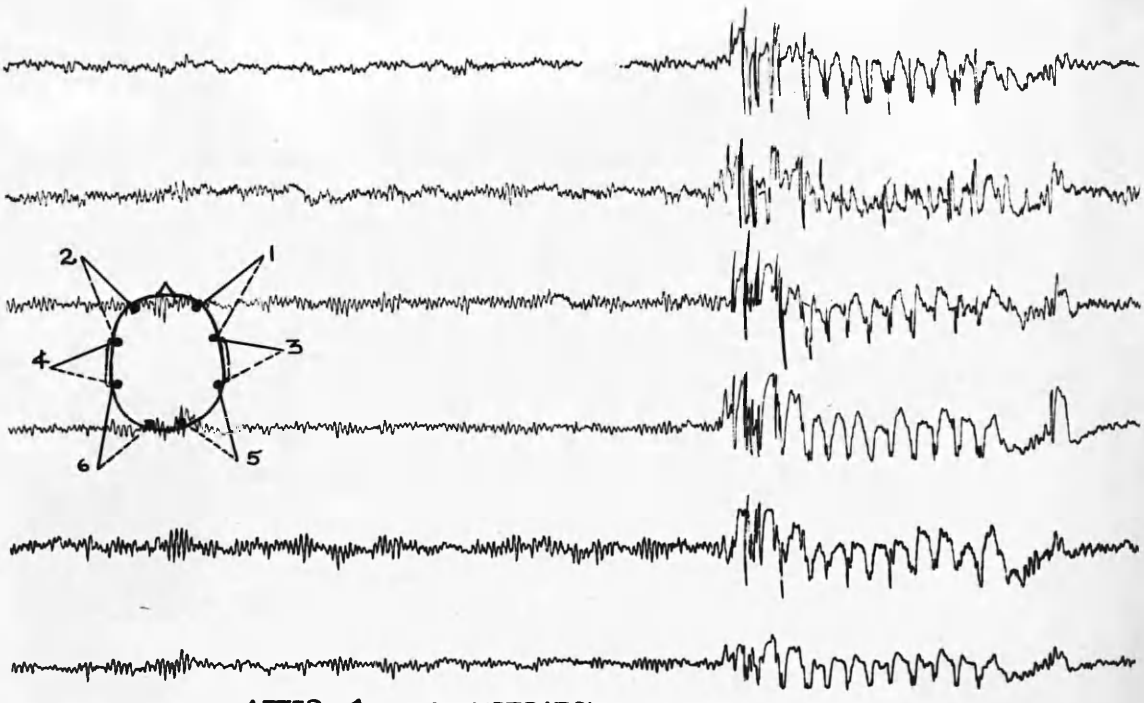
Previous personality: He was a slightly paranoid person; however, he had an excellent record at sports, and reached County Championship class at badminton.

History of present illness: Since the age of seventeen, he had had regular fits in his sleep. These consisted of a tonic and then a clonic stage. He never bit his tongue, nor was he ever incontinent. The attacks occurred usually at times of emotional and physical stress, and then only at rare intervals, but recently they had been happening about once per month.

On examination: There was no physical abnormality, but he appeared to be tense and anxious.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record showed an excessive amount of bilateral slow theta activity. Photic stimulation and seconal produced no change, but the injection of 240 mgm. metrazol produced some bilateral high voltage slow waves and a major seizure.

Progress: The diagnosis of idiopathic epilepsy having been confirmed, the patient was put on epamutin gr. 1½ at 5 p.m. and at 10 p.m. He was seen again early in 1950, since his attacks had become more frequent. The dosage of epanutin was increased, and phenobarbitone was prescribed as well.



J.S.W:- Atypical spike and wave discharge following the injection of 400 mgm. metrazol.

Mr. J.S.W. (27) 31.5.50.

Reason for referral: The investigation of infrequent fits which he had since 1943.

Family history: He had a sister who suffered from epileptic fits when she became excited.

Personal history: In childhood, he frequently walked in his sleep. His school record was good, and since leaving school he had worked successfully in the building trade. During the war he served in the Royal Marines for two years. He was invalided out after his first fit.

Previous personality: He had a good personality, and was a competent, hard-working man.

History of present illness: In his first attack, seven years earlier, he noticed that his right arm began to shake, and then he became unconscious. After that, no further fits were noticed until the end of 1948, when, one morning, he had an attack on rising from sleep. Again his right arm began to tremble, and he fell down twitching all over. The next attack occurred during the night, when he rose to go to the toilet. His wife heard him having a fit, went to his aid but he attacked her before falling unconscious to the floor. The last attack occurred in March, 1950, while he was having sexual intercourse with his wife. As before, his right arm twitched, he became cyanosed and lost consciousness. There was no history of tongue-biting or of incontinence.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. E.E.G. - The resting record was normal, but on over-breathing two atypical spike and wave complexes were seen. Photic stimulation at fifteen flashes per second produced one burst of spike and wave, but after the injection of 400 mgm. metrazol many long, repetitive, regular complexes of symmetrical spike and wave activity at four cycles per second, appeared for several minutes. Seconal produced no change.

Progress: He was put on a regime of epanutin and phenobarbitone, and when he was last seen in August, 1950, he had remained free from fits. There was no doubt that he was suffering from idiopathic epilepsy.

The next section contains the histories of a group of epileptic patients who showed no abnormality following the use of the provocative methods. They were all proven epileptics on clinical grounds.

Mr. P.B. (27) 11.7.49.

Reason for referral: Investigation of attacks in which he felt unreal. He had had these since 1940.

Family history: Both his parents suffered from migraine.

Personal history: His early childhood was uneventful. He had a reasonably good record at elementary and at technical schools. Subsequently, he worked as an engineer. He lived at home with his mother, and was unmarried.

Previous health: At the age of 18, he began to have attacks of migraine. Each attack commenced with a flickering of the eyes, then spots appeared before his eyes and a headache, accompanied by sickness, ensued. These attacks occurred about once in three weeks, and lasted for a whole day.

Previous personality: He was always rather shy and solitary, and was rather dissatisfied with his various jobs.

History of present illness: His first attack was in 1940, when he felt vague and as if he were in a dream. It lasted only two or three minutes. Nothing happened for two years, but subsequently he had about six attacks. The last two had a duration of three hours, and occurred within four months of each other. In the attack, he felt frightened, as if in a dream. Things around him seemed strange and unreal. Even on the next day he felt strange.

On examination: Physical: No abnormality was noted. Mental: He was seen to be a rather anxious, tense young man, but there was no evidence of thought disorder or of mental deterioration.

Special investigation: EEG. - The resting record showed no abnormality. Photic stimulation and the injection of 400 mgm. metrazol produced no specific change.

Progress: At first it was elicited that the patient had had an unsatisfactory love affair, and it was decided that he was suffering from an anxiety state. An attempt was made to treat his migraine by regular dosage of ergotamine tartrate, and his anxiety was dealt with by encouraging him to attend a supportive clinic where he could discuss his problems freely. In spite of these measures, his attacks of unreality occurred frequently, and there was no change in the incidence of his attacks of migraine. In spite of the negative investigations in March, 1950, his attacks were regarded as being possibly epileptic in nature, and he was given epanutin. On this regime, his attacks ceased, and his migraine vanished also. When seen last in November, 1950, he had had no attacks of either condition for eight months. This was the longest period of freedom he had ever had from the attacks of migraine since they first began.

It seemed most likely that the patient was suffering from idiopathic epilepsy.

Mr. L.B. (29) 9.11.49.

Reason for referral: The investigation of two fits which had occurred in the previous year.

Family history: The patient's paternal grandfather was an alcoholic, and died in a mental hospital.

Personal history: As a child he was nervous. He was afraid of the dark, fidgetted and would not go to sleep. At school he did well, and subsequently worked as a tool-maker for the Ford Motor Company. In 1948, he emigrated to South Africa, but was unhappy there, and after eighteen months he returned home to resume his former occupation.

Previous illness: When in South Africa, in 1948, he had an attack of "heat stroke" in which he fell to the ground unconscious.

Previous personality: He had been always an unstable, restless person, but he had been capable of good work.

History of present illness: For the previous three years, he had been more restless and unsettled than ever before. In February, 1948, he acted on an impulse in going to South Africa, and there, ten months later, he had his first fit. It occurred in sleep, and he bit his tongue but was not incontinent. During the attack, his limbs twitched violently, his eyes stared unseeingly and he frothed at the mouth. Afterwards he was confused for some time. Subsequently, he had transient attacks of depersonalisation, and at times he felt depressed and contemplated suicide. A second major seizure occurred during sleep in October, 1949, and this, which was essentially similar to the previous attack, was witnessed by his wife.

On examination: He was extremely tense and anxious, but there was no physical abnormality.

Special investigations: W.R. - Negative. X-Rays of skull and muscles were normal. EEG. - The resting record was within normal limits. Photic stimulation, seconal and the injection of 400 mgm. metrazol produced no specific change.

Progress: In spite of the negative investigations, he was considered to be suffering from epilepsy, and was treated with epanutin and phenobarbitone. He had one major seizure in December, 1949, and two further attacks in June, 1950. Then his medication was increased to epanutin gr. 1½ four times daily and phenobarbitone gr. 1 b.d. When seen in August, 1950, he was free from attacks, and subsequently nothing further was heard of him.

Mr. H.S.L. (19) 8.3.50.

Reason for referral and history of present illness:

This patient was referred by the Ministry of Labour, since he had had a history of one epileptic fit at work, and because he had changed his occupation fourteen times in a period of fifteen months.

His mother stated that for the previous nine months he had been suffering from severe headaches, which came on in association with excitement. They were followed by a generalised "flushing" and a "blackout". After such an attack, he sat down, stared around him and did not know where he was for about five minutes afterwards. He could hear noises going through his head.

He had been incontinent on only one occasion, when he had an attack in the middle of the night. In some of the attacks, he was said to foam at the mouth, and his limbs moved. The family doctor put him on phenobarbitone gr.i, b.d.

Family history: There was no history of nervous or mental disease.

Personal history: His birth was normal, but at the age of six weeks he developed gastro-enteritis and was in hospital for six months. When he was fourteen months old he fell on his head, but did not become unconscious. He was very nervous as a child. His education was interrupted by the war, and he had had a very inadequate schooling. He was duller than the other children, and always found difficulty in mixing with them. He had done labouring work since leaving school, and had rarely been able to hold a job for longer than two to three weeks during the past five years.

Previous personality: He was a rather dull, backward youth.

On examination: He was physically normal. Mental: The patient was rather truculent and paranoid. He expressed a great deal of resentment against his father, who was threatening to throw him out of the house because of his incompetence. The patient stated that the fits had begun with the impression that people were talking inside his head, and he could not hear what they said.

Special investigations: Skull X-Ray - Normal. Intelligence - Wechsler - verbal scale I.Q. 66. performance I.Q. 58. full-scale I.Q. 57. EEG. - The resting record was normal. Photic stimulation and the injection of 480 mgm. metrazol produced no change.

Progress /

Progress: The patient was looked on as an epileptic in spite of the negative EEG. findings, and he continued to take phenobarbitone gr. i, b.d.

On 9.2.51, he was brought up to hospital, having been found unconscious in a public lavatory. This attack was witnessed, and it was noted that he fell against the wall and slid slowly to the floor. Apparently, he had been having these attacks at regular intervals, and he stated that before an attack he heard a voice saying "Jumpout" or "Go on, do it".

In March, 1951, it was considered that phenobarbitone might be upsetting him, and he was put on epanutin gr. 1½ b.d.

He was heard of last in June, 1951. Then he had been fined £2 at a magistrate's court, after having been caught by the police when masturbating publicly, as he looked into the window of a barber's shop.

Reason for referral: The investigation of nocturnal fits which had begun two years earlier.

Family history: This was not relevant.

Personal history: She was a premature baby, and was born by breech delivery. She had temper tantrums in childhood. Her school record was good. She married two years earlier.

Previous personality: She had been an active, hard-working person.

History of present illness: During the previous two years she had had five epileptiform fits which occurred in the early morning, towards the end of sleep. There was no incontinence or tongue-biting. She had noted that the fits occurred only if she had gone without supper, and it was thought that they might be hypoglycaemic in nature.

On examination: There was no physical abnormality. She was a bright, garrulous individual.

Special investigations: W.R. - Negative. E.S.R., Serum Bromide, Glucose Tolerance and Insulin Sensitivity tests were all normal. EEG. - The resting record showed some diffuse slow activity. Activation with photic stimulation and seconal produced no change.

Progress: An accurate description of her attacks by her husband suggested that they were epileptic in character. Treatment with anti-convulsants was begun. A diagnosis of idiopathic epilepsy was made, and the question of attacks of spontaneous hypoglycaemia was ruled out.

Mr. B.L.C. (33) 17.10.49.

Reason for referral: The investigation of fits secondary to a head injury sustained in 1944.

Family history: There was no relevant information.

Personal history: His early life was uneventful. After leaving school, he became a printer. He joined the Army in 1940, and served until his injury in 1944. Since then, he had had difficulty in finding employment. He was married, and had three childrem.

Previous personality: He had been an ambitious, conscientious person.

History of present illness: In July, 1944, he sustained a gun-shot wound of right fronto-parietal area. Subsequently, he had a rib grant into hole in his skull. In July, 1945, he began to have fits which were Jacksonian in type. These were controlled partially by anti-convulsants, but he became irritable, quarrelsome and careless in his habits. He smoked excessively.

On examination: He was three stones under weight. There was an extensive scar of the right fronto-parietal area. He had a spastic paralysis of his left hand and forearm. He was inclined to be facetious and tactless. There was no other evidence of deterioration.

Special investigations: W.R. - Negative. Intelligence: Matrices I.Q. = 86. The Goldstein Test showed very little intellectual impairment. EEG. - The resting record showed a definite spike focus in the right motor area. This appearance was not altered by the use of scopo chloralose.

Progress: He was given a course of modified insulin therapy which increased his weight by one stone. Physiotherapy was arranged for his spastic arm, and he was treated adequately with epanutin and phenobarbitone, which reduced the frequency of his attacks. He benefited from superficial psychotherapy.

He was considered to be suffering from post-traumatic epilepsy, with consequent personality changes.

Master R.G.C. (10) 3.1.50.

Reason for referral: The investigation of fits which he had had since the age of ten months.

Family history: There was no history of any nervous disorder.

Personal history: His birth was normal, but he was backward in his development. He was late in speaking, and continued to have enuresis. His mother educated him until he was six, then until he was nine he attended an ordinary school where he was about two years behind the other children. About a year earlier, he had been sent to a private school for problem children, where his backwardness became even more pronounced.

Previous personality: He was always a happy, attractive boy.

History of present illness: At the age of ten months, he began to have attacks of petit mal, which occurred at weekly intervals. There were controlled effectively by luminal. When he was 2½ years old, the fits recurred, and he was put on bromide which caused bromide intoxication at the age of one years. After this, he was reasonably free from fits, but at the age of eight he began to have frequent attacks of pallor, and vomiting. In the last year, they had been associated with rapid physical and mental deterioration.

On examination: He looked rather emaciated, and there appeared to be a generalised briskness in all the tendon reflexes. He showed little response, and spoke only a little about food.

Special investigations: Intelligence - He appeared to have a mental age of two to three years only. His blood count was normal. The EEG. showed occasional bursts of spike and wave activity. There was no sign of any focal abnormality. The use of photic stimulation and seconal produced no change.

Progress: On an anti-convulsant regime which consisted of tridione and amphetamine sulphate he improved remarkably. He recovered a measure of speech and sphincter control. However, the balance between the control of his fits and intoxicating drug doses was very narrow. His general level of intelligence improved to the five-year-old level.

A final diagnosis of epilepsy and mental deficiency was made. When seen last in July, 1952, he was considered to be making fair progress. Then his I.Q. was 48.

Mr. H.W.D. (44) 2.1.50.

Reason for referral: He had begun to have fits recently.

Family history: His father died at the age of sixty-seven, after a series of cerebro-vascular accidents. He was aphasic and hemiplegic for one year prior to death.

Personal history: He had been backward as a child, and worked subsequently with his brother as a builder.

Previous personality: He had always led a rather sheltered life at home with his mother.

History of present illness: He had his first attack in March, 1949, while at his mid-day meal. In it he bit his tongue. This was followed by several others in which he was incontinent. In June, 1949, he had an operation for herniorrhaphy under a spinal anaesthetic. Following this, he had a series of attacks in which he bit his tongue so severely that he could not speak.

On examination: He was noted to be left-handed, but the movements of his right limbs were poor. He could not talk at all, and mouthed a wide variety of phrases.

Special investigations: W.R. - Negative. C.S.F. - Normal. Skull X-Ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: It was considered that his epilepsy was genuine, and was probably secondary to cerebral anteriosclerosis. However, aphasia and right hemiplegia were considered to be hysterical in nature, in view of (1) the lack of abnormal tone in the right limbs; (2) the occurrence of a so-called right hemiplegia and aphasia in a left-handed individual; (3) His aphasia consisted of a variety of whispered statements, instead of the repetition of one phrase only.

These symptoms disappeared following strong suggestion made under light barbiturate narcosis.

Mr. D.W.D. (34) August, 1950.

Reason for referral: Investigation of fits which he had had since 1948.

Family history: His parents were divorced, otherwise there was no relevant history.

Personal history: He was born and reared in India, where he was considered to be a healthy child. He was educated to the age of 16, and then worked in England for two years. Then he returned to India. In 1939, he joined the Army, and became a prisoner of war in 1943 in Italy. Since 1946, he had been attempting to settle in England. He was married and had three children.

Previous personality: An efficient, competent worker, who had few outside interests.

History of present illness: He adjusted badly to life in Britain and experienced much domestic stress. In 1948, he had his first fit, and these had occurred regularly at monthly intervals. He had an aura of gastric discomfort and twitching of the left side of the face, followed by jerking of the right arm and leg, before a generalised fit began. On one occasion, he had status epilepticus, and was admitted to an Observation Ward.

On examination: He was physically normal. Mental: He was a rather dull, slow-thinking person, whose concentration was poor.

Special investigations: W.R. - Negative. E.S.R. - 17 mm/hr. Serum Bromide - less than 25 mgm. per cent. C.S.F. - Normal. X-Ray, Skull - No abnormality was found. X-Ray, Muscles - No evidence of cysticercosis was seen.

EEG. 26.8.48. A moderately abnormal record, which showed generalised slow activity at 6-8 cycles per second in all areas, with normal post-central alpha. Some activity at 4-5 cycles per second was seen in the left hemisphere with no definite focus.

9.8.50. The record was almost normal, but showed some left frontal theta activity which disappeared on eye opening.

25.8.50. Again, there was presemt some non-focal theta activity in the left frontal area. The injection of 450 mgm. of metrazol produced no epileptic activity, but a syncopal attack associated with the appearance of high voltage delta activity which began in the left hemisphere. Photic stimulation was negative. 25.1.51. The record showed still some left frontal activity. Combined photic stimulation and metrazol injection produced no change.

Progress: In January, 1951, he was admitted to the Maudsley Hospital for further investigation. He was receiving Phenytoin gr. 1½ b.d., and phenobarbitone gr. ½ b.d., which appeared to control the attacks. He was seen by Mr. Murray Falconer, who arranged to undertake air studies. These showed an extensive bilateral frontal glioma (astrocytoma). The patient was referred for deep X-Ray therapy. A follow-up by a social worker revealed that the patient died in November, 1951.

Miss C.F. (29) 1.3.50.

Reason for referral: She complained of fainting attacks which had begun two months earlier.

There was no known family history. She had been brought up in an orphanage, and since leaving school had been employed as a hospital ward orderly.

Description of attacks: These occurred every four days. She experienced a pain in the right temple for one second, and then she fell down, losing consciousness at once. No muscle twitching, tongue-biting, incontinence or bruising were noted. She was unconscious for five to ten minutes.

On examination there were no abnormal physical signs.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record showed an excessive amount of low voltage fast activity. The use of seconal, photic stimulation and the injection of 400 mgm. metrazol produced no specific change.

Progress: Her attacks continued, and in September, 1950, it was noted that she had bitten her tongue in a seizure. Then she was treated by a combination of phenobarbitone and bromides. The attacks remained frequent in number, and early in 1951 she was put on epanutin as well. When last seen in October, 1951, there had been little change in the incidence of her attacks. She was considered to be suffering from idiopathic epilepsy.

Miss M.M.G. (58) 4.1.50.

Reason for referral: The investigation of fits which she had had at infrequent intervals since the age of twenty-two.

Family history: Her father was an alcoholic

Personal history: Her early life was difficult because of poor economic circumstances, and on leaving school she went into domestic service, where she has remained.

Previous personality: She had been always a conscientious, hard-working woman.

History of present illness: The attacks began at the age of twenty-two, and since then she had had one attack at roughly twelve-year intervals. She had an aura of feeling dazed, then she knew no more and fell on the floor. In several attacks she had bitten her tongue, and on one occasion she had injured her head, but there was no history of incontinence. In December, 1949, she had an attack in which she bit her tongue, and as a result of this attack she lost her job.

On examination: There was no physical abnormality, but mentally she was rather below average in intelligence.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. of metrazol produced no change.

Progress: In view of the history, the patient was considered to be suffering from idiopathic epilepsy, and her doctor was advised to treat her with anti-convulsant drugs.

Miss J.H. (14) 26.5.49.

Reason for referral: The investigation of regular attacks of confusion which she had been having for one year.

There was no relevant family history, and her early life was uneventful. She had not yet begun to menstruate.

Previous personality: She was a rather shy girl who found it difficult to mix with other people.

History of present illness: One year earlier, she had fallen in the school playground, striking the back of her head. She appeared to have had a momentary loss of consciousness, but there was no evidence of any injury. Two months later, she began to have recurrent attacks of confusion eight to nine times per day. Each attack lasted for a few seconds, and she felt as if she were in a dream, but remained confused for periods lasting up to one hour. There was no history of any headaches, fainting, tongue-biting or incontinence.

On examination: There was no physical abnormality. She was mildly anxious, and was below average in intelligence.

Special investigations: Skull-X-ray was normal. EEG. - The resting record was within normal limits for the age. Photic stimulation and seconal gr.3 produced no change.

Progress: It was considered that there was no true evidence that epilepsy was present, and it was thought most likely that she was suffering from a behaviour disorder, for which she was treated subsequently.

Miss W. L. Aged: 16 October, 1949.

Reason for Referral

The investigation of attacks of loss of consciousness, which she had had for two years.

Family History:

Her father and an elder sister suffered from similar attacks of loss of consciousness in association with headaches.

Her personal history was uneventful.

History of Present Illness:

In these attacks she experienced first a right frontal headache, which was followed by a loss of consciousness for a period of about ten minutes. In the attack she fell to the ground and occasionally injured herself but there was no history of tongue biting or of incontinence.

On examination:

There was no physical or mental abnormality.

Special Investigation:

Skull x-ray was within normal limits.
E. E. G. the resting record showed no specific abnormality and the use of photic stimulation, seconal and intravenous metrazol produced no change.
E. E. G. the resting record showed no specific abnormality and the use of photic stimulation, seconal and intravenous metrazol produced no change.

Progress

In view
Progress:

Patient was suffering from idiopathic epilepsy of the petit mal variety. She was treated successfuly with phenobarbital.

Mr. W.J.L. (37) 13.10.49.

Reason for referral: The investigation of fits which he had had since the age of fourteen.

Family history: There was no relevant information apart from the fact that one of his sisters suffered from fainting attacks.

Personal history: His early development was normal, but he was a nervous child, handicapped by a stammer. He did well at school, and subsequently worked as a porter at Covent Garden. During the war, he served in the R.A.S.C. for three years without any untoward incident.

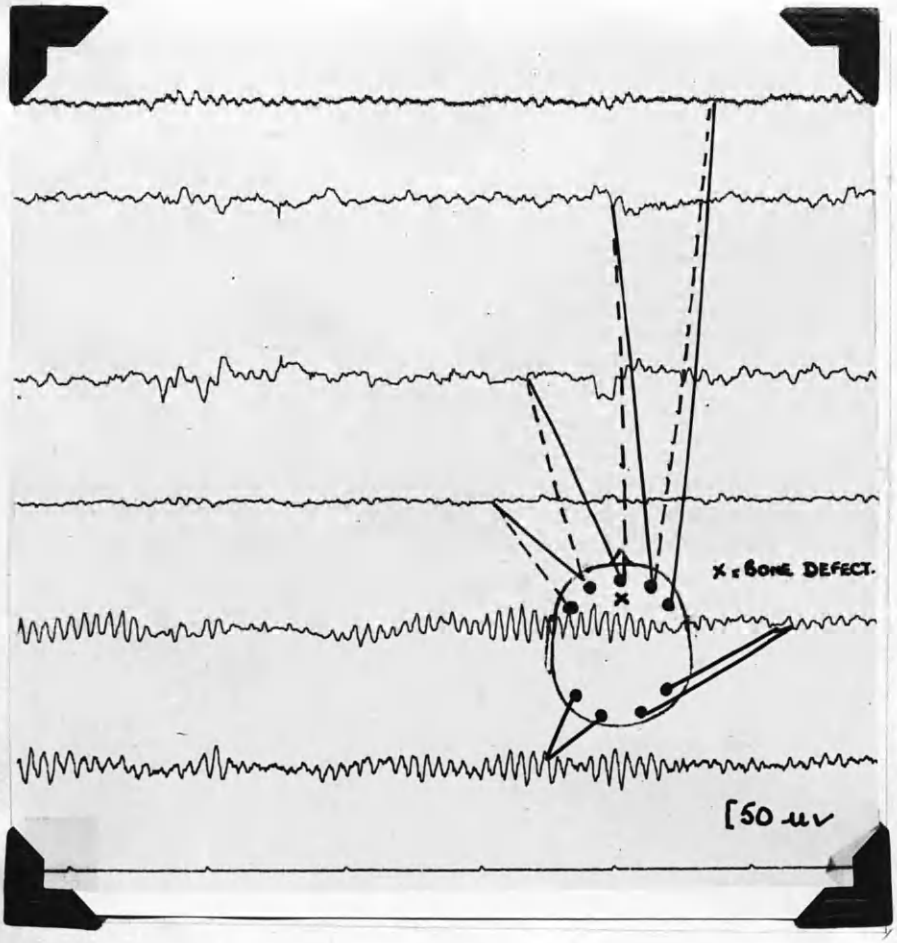
Previous personality: He was a conscientious, hard-working person.

History of present illness: His fits began when he was fourteen, and since then they had occurred at six-monthly intervals. Usually, he experienced a strong desire to defaecate, he fell down perspiring profusely, and then he became unconscious. Sometimes he passed a stool, but he never bit his tongue. Recently, his attacks had occurred a little more frequently.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - negative. E.S.R. and Serum Bromide were within normal limits. X-Rays of skull and muscles were normal. EEG. - The resting record was normal. The use of photic stimulation, seconal, and the injection of 400 mgm. metrazol produced no change.

Progress: In spite of the negative findings, a diagnosis of idiopathic epilepsy was made, and treatment with epanutin and phenobarbitone was begun.



P.M.:- Routine record showing frontal slow wave focus.

Captain P.M. (32) 2.1.50.

Reason for referral: The investigation of fits which he had had since 1944.

Personal history: He was born in Poland, and his early development was without incident. After a good school career, he joined the regular Polish Army as an officer-cadet, and eventually he rose to the rank of captain. Since his illness, he had been invalided from the Army, his work record had deteriorated, and recently he had found difficulty in holding labouring jobs.

Previous illness: At the age of sixteen he had been depressed and had made a suicidal attempt.

Previous personality: He had been fairly sociable, but had marked obsessive characteristics.

History of present illness: In November, 1944, during the campaign in Europe, he sustained a gunshot wound which penetrated the right frontal area. One year later, he had his first major epileptic fit, and since then he had had about eight attacks. Before his discharge from the Army, he got into trouble with the Polish Army authorities, accusing them of corruption. As a result of this, he was admitted to a mental hospital for several weeks, and was not awarded a disability pension.

On examination: He had a scar on the right forehead. He was pedantic and precise, but there was no evidence of depression or of deterioration.

Special investigations: W.R. - Negative. Skull X-ray - Bone defect, right frontal area. EEG. - This showed clear-cut focus of high voltage slow waves and occasional spikes in the right frontal area. The test was repeated following .75 G. scopo-chloralose, but this showed no significant increase in the amount of focal abnormality. Four hours later the patient experienced a severe reaction in which the pulse rate fell to 30 per minute, and he became temporarily disoriented. This attack was treated by intravenous methedrine.

Progress: He was put on epamutin and phenobarbitone, which reduced the frequency of his attacks, and a successful attempt was made to obtain a fair disability pension for him.

Mrs. P. O. Aged: 23 September, 1949.

on for referral:

complained of attacks of headaches which she had had at intervals for previous twelve years.

ly History:

mother suffered from migraine.

personal history was uneventful.

ory of Present Illness:

e 1937 she had been experiencing attacks of generalized headaches. These daches were always preceeded by fortification phenomena. Also, she rienced a feeling of pins and needles in the right hand and arm; and e was an area of numbness around her mouth. During the attacks she was le to talk for a period of twenty minutes. In some of these attacks she faint, lost consciousness and fell to the ground. However, there was history of tongue biting or incontinence.

xamination:

e was no evidence of mental or physical disorder.

ial Investigations:

l x-ray was within normal limits.
G. resting record was normal and the injection of 400 mgms. of Metrazol, use of photic stimulation, and seconal produced no change.

ress:

spite of these essentially negative findings, the patient was considered, nically, to be suffering from idiopathic epilepsy and was treated as such h anti-convulsant drugs. There was no marked improvement.

Reason for referral: Encopresis and enuresis which had existed since he was eight years old.

Family history: The father had a criminal record and the mother had a psychopathic personality. Two older brothers were delinquents, and one sister suffered from vasomotor attacks.

Personal history: His mother could not remember the details of his early life. In 1940, he was evacuated to Wales, and on his return in 1943 he was noted to be encopretic and enuretic. Thereafter, he lived in evacuation hostels until the end of the war. His school record had been a poor one.

Previous illness: He had suffered from measles, whooping cough, chicken-pox and rheumatic fever.

Previous personality: He always gave the impression of being an over-active, superficially bright boy.

History of present illness: At the age of eight, while in a foster home in Wales, he became enuretic by night and encopretic by day, practically every day. On his return to London in 1943, it was noted that he pilfered from shops frequently, and on being charged in 1947, he was put on probation on condition that he attended the Maudsley Hospital for psychiatric treatment. In the course of his attendances, the criminal propensities ceased to be a cause for complaint, but the encopresis and enuresis remained unchanged.

On examination: Physical: There was some impairment of the second aortic sound. He was a rather undeveloped boy for his age. Mental: He appeared to be a bright, over-active boy, who was rather ashamed about his faulty habits. He was worried because his mother was again pregnant, and he was rather hostile in his attitude towards his father.

Special investigations: W.R. - negative. E.S.R. - 2 mm. Intelligence - Binet, I.Q. 98. EEG. - The records showed paroxysmal fast and slow activity, which was suggestive of a diagnosis of epilepsy. Photic stimulation, the administration of seconal and the injection of 400 mgm. of metrazol produced no specific change.

Progress: While in hospital, his encopresis did not manifest itself, and his nocturnal enuresis was controlled by amphetamine sulphate gr.10, omne nocte. He showed no delinquent tendencies, and his general behaviour was very good.

He was discharged from hospital without a diagnosis of epilepsy having been made. However, when he was seen in September, 1949, he described two occasions on which he lost consciousness while tree-climbing, and fell to the ground. He was looked on as an epileptic then, and was treated with epanutin and phenobarbitone. Throughout 1950, 1951 and 1952 he failed to keep appointments, and nothing further was heard of him.

Mr. B.J.P. (19) 6.6.50.

Reason for referral: Recurrent stealing of recent origin.

Family history: There is no evidence of any disorder.

Personal history and history of illness: His birth and early development were normal, but when at school it was noted that he had a violent temper, and on one occasion he banged another boy's head on the ground until the boy lost consciousness. At the age of 13 he had to leave a public school because he had been caught stealing savings stamps. After a year, he returned to his public school and subsequently took school certificate, but he was expelled again after further thefts. He then went to a private school from which he was expelled for sodomy. At the age of 17 he complained of blackouts, but when he was 18 he succeeded in joining the Royal Marines. However, he was invalided out after a few months, with a diagnosis of idiopathic epilepsy. Recently, he stole £130 from his landlady and several articles from his father before giving himself up to the police.

Previous personality: A lazy, self-indulgent, untruthful youth.

On examination: Physical: C.V.S.) C.N.S.) N.A.D. R.S.)

Mental: He is rather diffident, and shows little emotion in relation to his past misdeeds.

Special investigations: W.R. Negative. E.S.R. 3 mm.
Intelligence: Matrices I.Q. 116. EEG. The resting record contains a great amount of medium voltage slow theta activity which is increased on photic stimulation and following the injection of 400 mgm. metrazol. However, no specific epileptic features are present.

Progress: In spite of the negative EEG. results, he was regarded as an epileptic, and his fits controlled by epanutin gr. 1½, four times daily. However, it proved impossible to gain a sufficiently adequate rapport with him to attempt psychotherapy. He was suspected to be pilfering from the other patients. During his stay in hospital he became engaged to a female patient who was a lesbian. In view of the lack of progress, he was discharged to the care of a probation officer, who undertook to supervise him. On discharge, diagnoses of epilepsy and of psychopathic personality were made.

It was learned that soon after discharge he was arrested on a charge of stealing from his landlady.

Miss D.P. (18) 3.5.50.

Reason for referral: The investigation of fits which she had had since the age of fourteen.

Personal history: Her early development was normal, but subsequently she was considered to be a backward scholar at school. Later, she had worked as a domestic in an orphanage, and more recently as a packer in a sausage factory.

Previous personality: She had been always a fairly shy and sensitive girl.

History of present illness: Since the age of fourteen, she had been having attacks at weekly intervals which occurred usually in the late evening. Each attack was preceded by an aura in which her head felt hot, she perspired, she could see people talking, but was unable to hear what they said. After that, she lost consciousness. There was no history of tongue-biting or incontinence.

On examination: There was no physical abnormality, but she appeared to be rather below average in intelligence.

Special investigations: Skull X-ray - Normal. EEG. - The resting record showed some sharp waves in the right temporal region, but photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: Clinically, she was considered to be suffering from epilepsy, and she was treated with epanutin and phenobarbitone.

Reason for referral: He had had attacks of lapses of consciousness at intervals during the past year.

Family history: The patient's father died as a result of dementia paralytica. He had a cousin and a niece who were said to suffer from fits.

Personal history: His birth was normal, but he was a nervous child who was afraid of the dark. He did well at school, and after leaving school he worked in the mines for two years. Since the age of sixteen, he had been a driver. He spent the war years as a driver with the R.A.S.C. in the Middle East, and since the end of the war he had been employed as a bus driver by London Transport. In his spare time, he had run an ice-cream van. He was happily married, and had two children of whom the younger was rather nervous. He smoked fifty cigarettes daily.

Previous illnesses: These included the following: (i) a head injury at the age of eighteen; (ii) malaria in 1944; and (iii) brief concussion after a landmine explosion in 1944.

Previous personality: He had always been an ambitious, hard-working, conscientious man. His temper had been rather quick, but he had always had a good reason for losing it. Since he had been running an ice-cream business as well as driving a bus, he had not had a lot of sleep.

History of present illness: About one year ago, he began to have momentary lapses of consciousness which occurred about six times each day. He was really partially conscious in the attack, and did peculiar things, such as putting a table-mat inside the tea-pot instead of the tea. At other times, he had transient feelings of unreality. His own doctor treated him with luminal, which reduced the frequency of the attacks.

On examination: There was no physical abnormality.
Mental: Patient appeared to be an alert individual who showed no evidence of any deterioration, and no thought disorder.

Special investigations: W.R. - Negative. E.S.R., 2 mm. EEG. - The resting record was normal. The use of seconal, photic stimulation and the injection of 400 mgm. metrazol failed to elicit any epileptic phenomena. Skull and Muscle X-Rays - Normal. Intelligence: I.Q. Matrices 92.

Progress: In view of the classical nature of the attacks, and in the absence of any previous nervous disorder, a diagnosis of idiopathic epilepsy (petit mal) was made. This was in spite of the negative findings. He was advised to give up his job as a bus driver, which he did, and subsequently became a bus conductor. The form of his attacks remained unchanged, but their frequency was kept down by a regular dosage of phenobarbitone.

Reason for referral: The investigation of fits which he had had since 1941.

Family history: His mother was an unstable alcoholic, and he had one sister who suffered from migraine.

Personal history: In childhood, he had had attacks of biliousness which were followed by migraine in adolescence. He had been an average scholar at school, and worked subsequently as a journalist.

Previous personality: He had been a quiet, anxious person with perfectionist tendencies.

History of present illness: At the age of twenty-four, he began to experience momentary attacks of confusion. These occurred regularly, and at the age of thirty he began to have more active experiences. His aura consisted of a feeling that everything was unreal, and this was followed by generalised twitching movements which were associated with double incontinence. With the attack, he became sexually excited and afterwards he felt fresh and active. In 1947, he was seen at the National Hospital, Queen Square, and was considered to be suffering from epilepsy. However, the attacks continued.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. C.S.F. - Normal. Skull X-Ray and air encephalogram showed no abnormality. Intelligence: Wechsler, I.Q. 140. EEG. - The resting record was a normal one. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: He was observed in the hospital to have occasional major fits in which he spun round to the left before falling to the ground. It was considered, on clinical grounds, that he was suffering from epileptic fits which began in the right temporal area and spread to the rest of the brain. The attacks were stabilised by epanutin gr. 1½ four times daily and phenobarbitone gr. 1 b.d.

Mr. J.S. (42) 9.3.50.

Reason for referral: The investigation of attacks which he had had for three months.

There was no known relevant family or personal history.

Description of attacks: Each episode started with a hot feeling in the stomach which was followed by numbness in his chest. Then everything went black, but he did not lose consciousness, nor did he fall down. He experienced a sensation of pins and needles in his hands. Each attack lasted only for two minutes.

On examination, no abnormal signs were noted.

Special investigations: W.R. - Negative. Skull X-ray was normal. EEG. - The resting record showed a good dominant alpha rhythm. Photic stimulation and the injection of 400 mgm. metrazol produced no specific change.

Progress: He was treated as an epileptic, and was given phenobarbitone. This was combined with amphetamine sulphate and by July, 1950, it had reduced the frequency of his attacks.

Mr. A.S. (48) 16.3.49.

Reason for referral: The investigation of attacks of dizziness, which he had had during the previous year.

There was no relevant family or personal history.

Description of attacks: For about one year, he had been having attacks lasting for five minutes, in which his mind went numb. He never lost consciousness, but he had to hold on for support, and when talking he had difficulty in finding the correct word. After an attack, a grey, misty patch appeared in the centre of his field of vision. These attacks occurred at monthly intervals.

On examination: There was no abnormality noted. He was referred to the Ear, Nose and Throat Department of King's College Hospital, and labyrinthine vertigo was excluded.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record showed some generalised spike activity, but photic stimulation and the injection of 400 mgm. metrazol evoked no abnormality. An air encephalogram showed no evidence of any lesion.

Progress: He was treated with phenobarbitone, gr. ½ b.d. and on this regime his attacks of dizziness became much less frequent. When he was seen last in May, 1950, he was practically free from them. It seemedlikely that the diagnosis was one of idiopathic epilepsy.

Mr. H.-. (34) 5.4.50.

Reason for referral: A fainting attack which he had four months earlier.

Family history: This was not relevant.

Personal history: He was born and brought up in Canada. At the age of twenty he came to London and joined the Metropolitan Police. He was married, and had four children.

Previous health: In 1939, he fell a distance of eighteen feet from a roof while chasing a burglar. He was unconscious for a short while. No abnormality was found when he was examined at hospital. He had rheumatic fever in 1940, as a result of which he was considered to be unfit for war service, and was subsequently employed on station duties in the police.

Previous personality: He appeared to have been a rather sensitive, hypochondriacal man.

History of present illness: In 1940, he had a fainting attack in which he bit his tongue. After this, he had a severe headache, and a police doctor made a diagnosis of migraine. During the war, his wife witnessed another attack. It was on a bus journey on which he had been sick. His eyes rolled, and he appeared to have been confused. However, he did not fall down. In 1948, he fainted while at the telephone switchboard, and bit his tongue. His last attack was in January, 1950, when he fainted in the street while on duty. At no time had he been incontinent.

On examination: The only physical abnormality was the presence of an apical systolic murmur. On mental examination, he showed no evidence of deterioration. He felt that he had been passed over for promotion by reason of his poor health record, and was rather resentful about this.

Special investigations: Skull x-ray was normal. EEG. - The resting record was normal, photic stimulation produced no abnormality and a record in seconal sleep showed no change. In view of the history of rheumatic fever, he was not given metrazol.

Progress: Although the various tests showed no abnormality, it was decided to regard him as an epileptic by reason of his history of tongue-biting. He was treated with epanutin and phenobarbitone.

Mrs. G.A.W. (58) 26.4.50.

Reason for referral: The investigation of fits which she had had for many years.

Family history: Information was not relevant, apart from the fact that one of her brothers was a mental defective.

Personal history: She fell from a swing as a baby, and injured her head. Otherwise, her early life was uneventful. After leaving school at fourteen, she did factory work and dressmaking until marriage at the age of twenty-eight. She has had three sons and four daughters. All the daughters were highly-strung.

Previous personality: She was always a neat, obsessive, conscientious and sensitive person.

History of present illness: She had had fits since her fall from a swing at the age of ten months. In adult life, she had these attacks most frequently in the pre-menstrual phase, and her longest period of freedom had been for three months during pregnancy. She had always an aura lasting for a few minutes, which allowed her time to take her teeth out. The attack began by her falling forwards or backwards. This was followed by a prolonged cry, then she bit her lips but never her tongue. The clonic stage of generalised twitching movements came next. She was never incontinent during the attack. After the fit, she always had a short sleep and felt quite well. Since the menopause, six years earlier, the fits had occurred only once in two months, but she had had increasingly frequent attacks of depression. These occurred regularly, every two weeks, and in them she was irritable, tearful, slept badly and had suicidal ideas. In 1945, she had attempted suicide by gassing, and had been sent to an observation ward. As long as she could remember, she had imperfect function in the left hand.

On examination: Physical: The left arm was one inch shorter than the right. The finger nose test with the left fore-finger showed some impairment. The tendon reflexes were more prominent in the left upper limb than in the right. Mental: She was rather anxious, but showed also some depressive features. She was mildly retarded and her sleep was disturbed in that she tended to waken early in the morning.

Special investigations: Skull X-Ray showed no abnormality. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: On the basis of her history, a diagnosis of post-traumatic epilepsy secondary to an old injury of the right parietal region was made. Her mental symptoms were classified as a menopausal depression.

Reason for referral: The investigation of fits which began in October, 1949.

Family history: The maternal grandmother showed acromegalic changes and suffered from diabetes. The paternal grandmother was a very simple woman, and her father suffered from a mental illness.

Personal history: Her birth and early development were normal. She reached her milestones fairly quickly, and had no neurotic traits in early childhood. At the age of six she had a very severe attack of scarlet fever. She progressed normally at school until the age of ten, when it was noted that she appeared to be backward. Menstruation began at the age of eleven, and since then she had been making frequent sexual advances to the opposite sex.

Previous personality: She was said to have been a normal, happy child until the age of six.

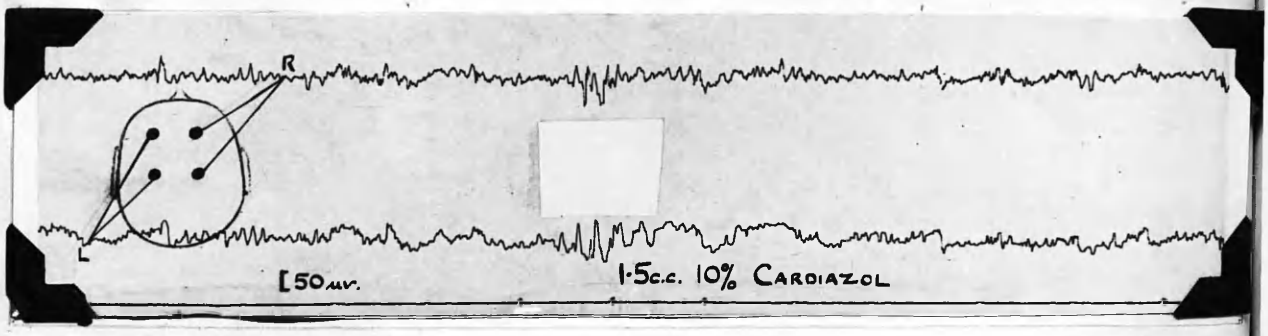
History of present illness: Her parents noted, after her attack of scarlet fever at the age of six, that her behaviour changed. She became aggressive, and had frequent temper tantrums. When she was eleven, she grew more rapidly and began to show erotic behaviour. About a year earlier, her mother noted transient lapses of attention, and in October, 1949, she had had several fits in which she made giggling noises.

On examination: She was rather over-developed for her age, but was otherwise normal. Mental: She was rather fatuous in her manner.

Special investigations: W.R.- Negative. E.S.R. - 8 mm. Glucose tolerance and insulin sensitivity tests were within normal limits. X-Ray - Skull: Bones of calvarium were smaller than normal. Hands: The joint changes were consistent with a diagnosis of Laurence Moon Biedle Syndrome. Intelligence: The tests showed results in which she achieved an I.Q. of 95 in performance tests, but only 65 in tests of verbal ability. B.M.R. = Minus 42 (17.2.50) plus 1 (30.3.50) 17 - Ketosteroids = 15.9 mgm. EEG. - The resting record showed paroxysmal disturbances suggestive of a diagnosis of epilepsy. The use of photic stimulation, seconal and the injection of 400 mgm. metrazol failed to produce any specific change.

Progress: In view of the low basal metabolic rate, she was put on thyroid gr.½ b.d. This sufficed to restore her basal metabolic rate to normality. Her behavious altered and she became more sociable. During this period, she had several nocturnal fits in which laughter occurred. She returned to school from hospital, and continued to make fair educational progress. Diagnoses were made of (i) Laurence Moon Biedle Syndrome, and (ii) Symptomatic Epilepsy. When she was seen last April (1952), there was no further history of attacks, but she was having difficulty in keeping her jobs.

In the following section the histories are given of a further series of patients who responded to the provocative methods in a positive manner. Initially it was thought that they were all suffering from epilepsy but their subsequent histories proved otherwise.



D.L.A:- Bilaterally synchronous atypical spike and wave after the injection of 150 mgm. metrazol.

Mrs. D.L.A. (28) Dec. 1949.

Reason for referral: Feeling of going unconscious which she had had at intervals for the previous six years.

Family history: This was not relevant.

Personal history: Her early life was uneventful. She married at the age of 23, and had two children. Her marriage was not altogether a happy one, and the second child was unwanted.

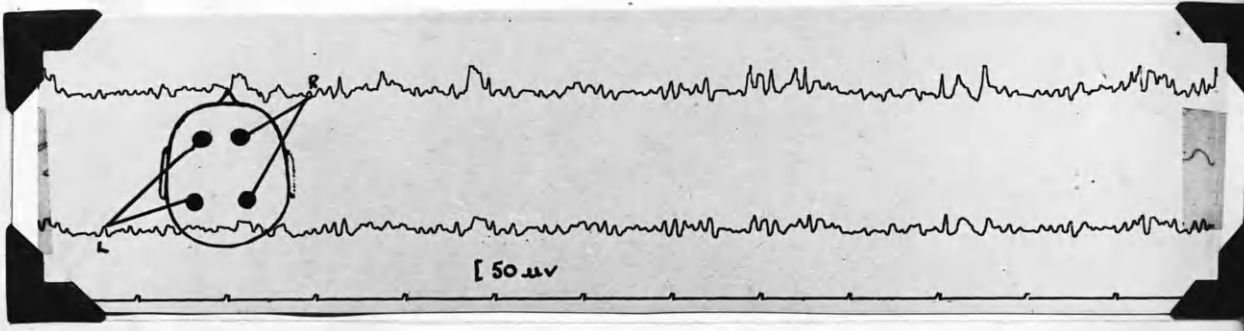
Previous personality: She had been always a shy person who was easily upset.

History of present illness: She was very upset by her mother's death in 1943, and soon afterwards she began to suffer from a feeling in her head as if she were going to "pass out", with a sensation of falling. After the birth of her second child in 1947, her symptoms got worse; on occasion she became terrified and everything went dark before her eyes. She thought she was going mad, and had a fear of injuring her daughter and of committing suicide.

On examination: There was no physical or mental abnormality of note.

Special investigations: Skull x-ray was normal. EEG. - The resting record was normal, and the use of photic stimulation and oral seconal produced no change. The injection of 150 mgm. metrazol produced a burst of bilaterally-synchronous atypical spike and wave activity.

Progress: She was considered to be suffering from anxiety hysteria secondary to a difficult home situation. She was treated successfully by superficial psychotherapy, and made an uneventful recovery.



Q.B.:- Bilateral slow wave discharge after the injection of 280 mgm. metrazol.

Miss Q.B. Aged: 40 December, 1949.

eason for Referral:

he complained of headaches associated with twitching movements of the imbs which she had had for five years.

amily History:

father was said to suffer from major epileptic fits.

r personal history was uneventful.

istory of Present Illness:

rom time to time during the previous five years she had experienced eadaches, which affected the left temporal region. Each heacache s associated with twitching movements of her arms and legs. She was uite unable to control these movements. At no time did she lose onsciousness, nor was there any history of tongue biting or incontinence.

n examination:

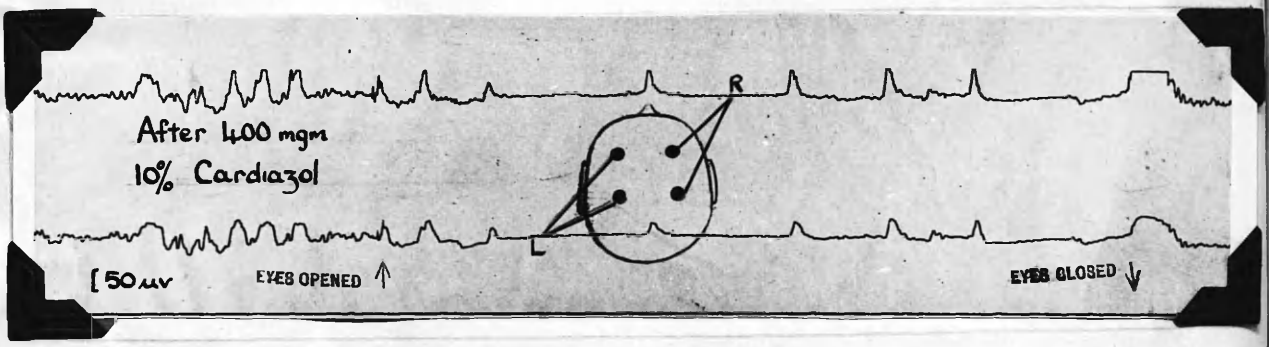
here was no evidence of mental or physical disorder.

pecial Investigation:

kull x-ray was within normal limits.
.E.G. resting record showed no abnormality, photic stimulation and the se of seconal produced no change. The injection of 280 mgms. Metrazol n divided doses, intravenously, produced a burst of generalized, medium-voltage, slow theta activity at 5-6 c.p.s..

Progress:

In view of the family history, and of the abnormality provoked by the injection of Metrazol, it was thought that the patient had an epileptic diathesis; but that her present complaint was one of migraine, without any relationship to epilepsy. The condition was treated as such on general lines.



F.C.D:- Bilateral slow wave discharge after the injection of 400 mgm. metrazol.

Mrs. F.C.D. (38) March, 1950.

Reason for referral: A four years' history of attacks of blank feelings in her head.

Family history: Her mother was said to have suffered from fits from the age of 46 to 64, when she died.

Personal history: Her childhood was an unhappy one, and she had many neurotic traits. She found it difficult to get on at school, and later to adapt to earning her living. She was married, but was unhappy with her husband. There was one child who suffered from temper tantrums and was being treated at the Child-Guidance Clinic.

Previous personality: She had been always a rather querulous, unhappy woman.

History of present illness: Her symptoms had begun four years earlier following the birth of her child. She began to experience blank feelings in her head, as if it were swollen, and she had also cramp-like pains at the back of her head. These were associated with pain in the epigastrum, depression, bouts of crying, suicidal thoughts and a fear of the dark. There was no history of true unconsciousness, tongue-biting or incontinence.

On examination: There was no physical abnormality, and she was thought to be a rather tense, anxious person.

Special investigations: Skull X-ray was normal. EEG. - The resting record was normal, and photic stimulation produced no change. The injection of 400 mgm. metrazol produced a burst of bilaterally synchronous slow waves with some spike potentials.

Progress: There was no doubt that this patient was suffering from hysteria, but it was thought that she had inherited an epileptic diathesis which enabled the positive reaction to metrazol to appear. She was treated by superficial psychotherapy.

Mrs. A.G: Bilaterally synchronous frontal slow activity after the injection of 250 mgm. metrazol.

Mrs. A.G. (47) 4.12.50.

Reason for referral: She complained of attacks in which she could not see, and in which she lost the use of her limbs. These had begun three months earlier.

Family history: The patient had two brothers who were highly-strung, and had quick tempers.

Personal history: Her early life was uneventful, and her school and employment records had been good. Menstruation had begun at the age of 17, and there was no evidence that she was menopausal. She had been married for twenty-five years, and had two sons. Her husband had been frequently unfaithful to her, and she had become over-attached to her family. The elder son had intimated his intention of marrying about six months earlier.

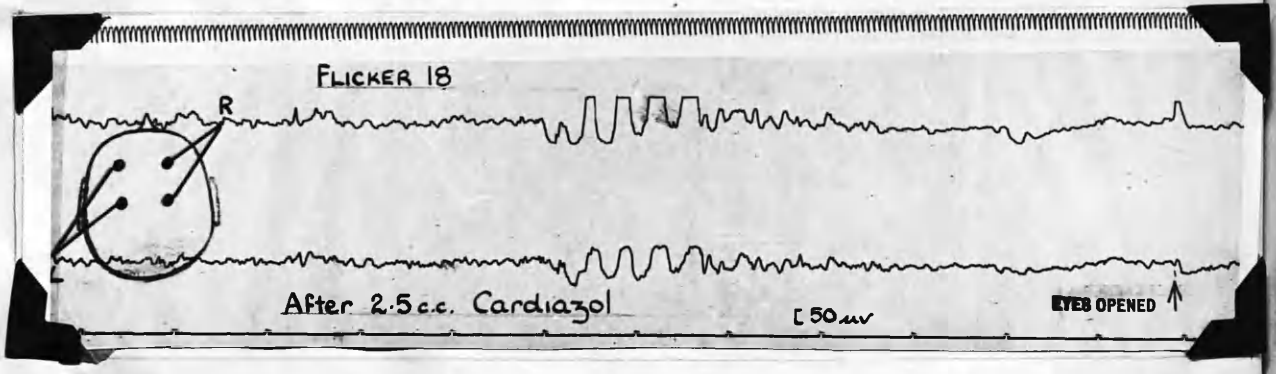
Previous personality: She had always been an over-anxious individual.

History of present illness: Since her son had informed her that he was leaving home to marry, she had had repeated attacks of anxiety, and had found it difficult to eat and sleep in her accustomed manner. She experienced choking sensations, and felt sick quite frequently. She began to experience headaches, and felt sure that something was going to burst inside her head. In these attacks, her limbs became powerless, and she lost her vision.

On examination: There was no physical abnormality. She was extremely anxious, and many of her symptoms were obviously hysterical in nature.

Special investigations: Skull X-ray was normal. EEG. - The resting record was within normal limits, photic stimulation produced no change, but the injection of 250 mgm. metrazol produced a burst of bilaterally synchronous frontal slow activity.

Progress: In spite of the positive response to metrazol, it was not considered that she was suffering from epilepsy. Instead, a diagnosis was made of an acute anxiety state with hysterical features. This was thought to be secondary to her son's intention of marrying and leaving home. She was treated successfully by methedrine abreactions and supportive psycho-therapy.



B.G:- Bilaterally synchronous slow activity produced by the combination of photic stimulation at 18 flashes per second with the injection of 250 mgm. metrazol.

Miss E.B.G; (18) 23.5.50.

Reason for referral: Attacks of loss of power in both legs during the previous eighteen months.

Family history: An older sister had recently had similar attacks which had been diagnosed as hysteria at another hospital.

Personal history: She had been a nervous child, enuretic to the age of five, and a persistent nail-biter. She had not done remarkably well at school, but subsequently she had a fair employment record.

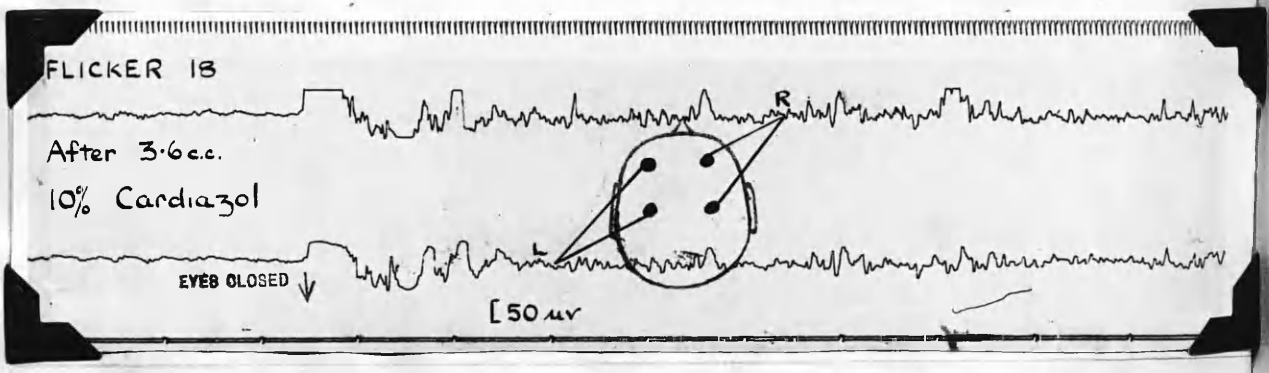
Previous personality: She was a shy girl, who was inclined to be easily upset.

History of present illness: Her attacks began with the feeling that she had no legs, and that the world around her was unreal. She became depressed, and thought of suicide. She saw double with two eyes and with each eye separately. In May, 1950, she began to have fainting attacks which occurred thus: In her sleep she had a recurring dream in which she saw the faces of young women. In the day-time when she tried to recall the faces of the girls in the dream she fainted. She lost consciousness suddenly, on one occasion nearly falling into the fire, and on another smashing a teapot and scalding herself. These attacks lasted for two minutes, but there was no incontinence or tongue-biting.

On examination: There was no physical or mental abnormality.

Special investigations: Skull X-ray was normal. EEG. - The resting record showed no abnormality, and photic stimulation alone produced no change. The injection of 250 mgm. of metrazol produced a short burst of bilaterally synchronous spike and wave activity which recurred after stimulating again with a photic stimulus at 18 f.p.s.

Progress: It was considered that these fainting attacks were epileptic in type, and she was treated with anti-convulsant drugs, but these did not seem to affect the frequency and nature of the attacks.



E.M.G:- Bilaterally synchronous spike and slow wave activity produced by photic stimulation at 18 flashes per second after the injection of 360 mgm. metrazol.

Mrs. E.M.G. (36). Jan., 1950.

Reason for referral: Fainting attacks which she had had for four years.

Family history: This was not relevant.

Personal history: She had been made an orphan at an early age, and was brought up by a maternal aunt. In childhood, she had been sexually assaulted by her adoptive father. Her school record and subsequent employment record as a telephone supervisor were good. She was married and had two children, but her husband did not get on well with the children, and there was also a great deal of financial stress.

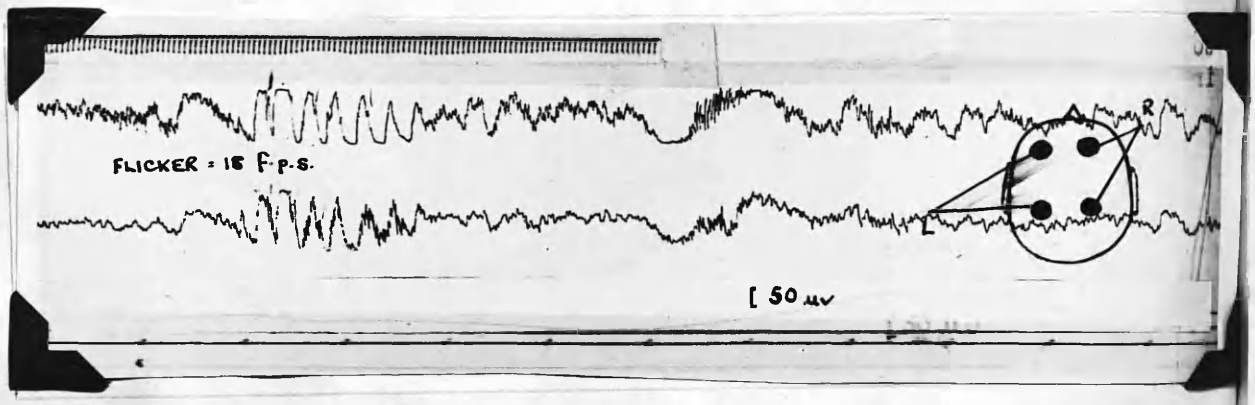
Previous personality: She was regarded as being a sensitive, highly-strung woman.

History of present illness: Her fainting attacks had begun four years earlier, at the time her husband came home from H.M. Forces. In the attack, she felt something hot coming up inside her, and she could not get her breath. Her heart beat rapidly and she got a headache which she described as being like an iron band, like boiling blood in her head. She felt herself fighting for breath, and gripped the hand of anyone nearby to prevent herself from fainting. Her husband stated that she was never unconscious, and that there was no incontinence or tongue-biting.

On examination: There was no physical or mental abnormality.

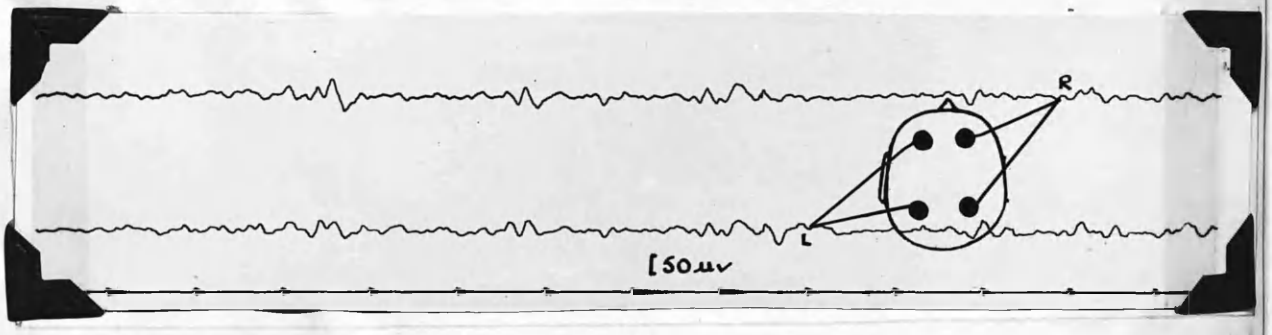
Special investigations: Skull X-ray was normal. E.E.G. - The resting record showed no abnormality, and photic stimulation alone provoked no change, nor did the injection of 360 mgm. metrazol. However, the subsequent re-application of photic stimulation at 18 f.p.s. produced a burst of bilaterally synchronous spikes and slow waves.

Progress: In spite of these findings, a diagnosis of anxiety hysteria was made, and she was treated successfully by superficial psychotherapy.



M.H:- Bilaterally synchronous spike and wave activity produced by photic stimulation at 18 flashes per second after the injection of 500 mgm. Metrazol.

Reason for referral: The investigation of a recent criminal episode which was alleged to be due to an epileptic attack.
Family history: His father, a prominent lawyer, was a man of marked temper who had deserted the mother on several occasions. His mother suffered from migraine, and was noted also for her temper.
Personal history: He developed normally, but was a rather solitary boy. At his schools, he was considered to be abnormally backward. Subsequently, with coaching, he passed the Law Society examination. At eighteen, he entered the Army, where he was frequently in trouble. His C.O. advised a psychiatric opinion, but his father opposed this, and so he was sentenced to nine months' detention. The prison medical officer, however, had him invalided from the Army as a psychopathic personality. Then his father wished to enter him for the Bar, but his mother wanted him to become a solicitor. However, the Law Society turned him down in view of his Army record, and the way was open for him to become a student of the Inner Temple.
Previous illness: After leaving the Army, he got drunk frequently in public places, and was prosecuted several times, much to his father's embarrassment.
Previous personality: He had been always over-attached to his mother. In his manner he was clumsy, but he had a gift of great verbal ability.
History of present illness: One month earlier, he had been brought to London by his father to be enrolled for the Bar, but he was left to return home alone. Instead of doing so, he spent the rest of the day drinking beer until closing time. The night was spent in a hotel, and the following morning he felt too ill to return home. He began drinking again, until a late hour in the evening. After he left the bar, he remembered getting out of an underground train, and knew no more until he found himself in a police station half-an-hour later. In the interval he had broken into a house and had been arrested within a few minutes. His behaviour was attributed to epilepsy, and he was put on probation, provided he had treatment.
On examination: There was no physical or mental abnormality.
Special investigations: W.R. - Negative. Skull X-Ray - Normal.
Intelligence: Matrices I.Q. 110. Mill Hill (Vocabulary) I.Q. 140.
EEG. - The resting record showed a moderate amount of slow theta activity. Hydration with five pints of beer produced no change, nor did seconal or photic stimulation alone, but the injection of 500 mgm. metrazol plus photic stimulation at 18 flashes per second produced a burst of spike and wave at 4 cycles per second.
Progress: It was considered that he was not suffering from epilepsy, but that he was an immature person showing marked emotional instability. He had a craving for alcohol which it was possible to control by giving him dextro-amphetamine sulphate mgm. 15 b.d. Arrangements were made for him to have psycho-therapy as an out-patient while reading for the Bar.



S.J.H:- Syncopal attack associated with the presence of bilateral slow activity after the injection of 400 mgm. metrazol.

Mr. S.J.H. (31) 10.1.50.

Reason for referral: He complained of a feeling that he was going to faint, and was afraid that he was an epileptic. He had felt like this for eight years.

Family history: Maternal grandfather was an epileptic. Otherwise there was no other relevant history.

Personal history: His birth and early development were normal, but he was a nervous child who had frequent nightmares, and was afraid of the dark. His school and work records were normal. He had been married for eight years, and had two children..

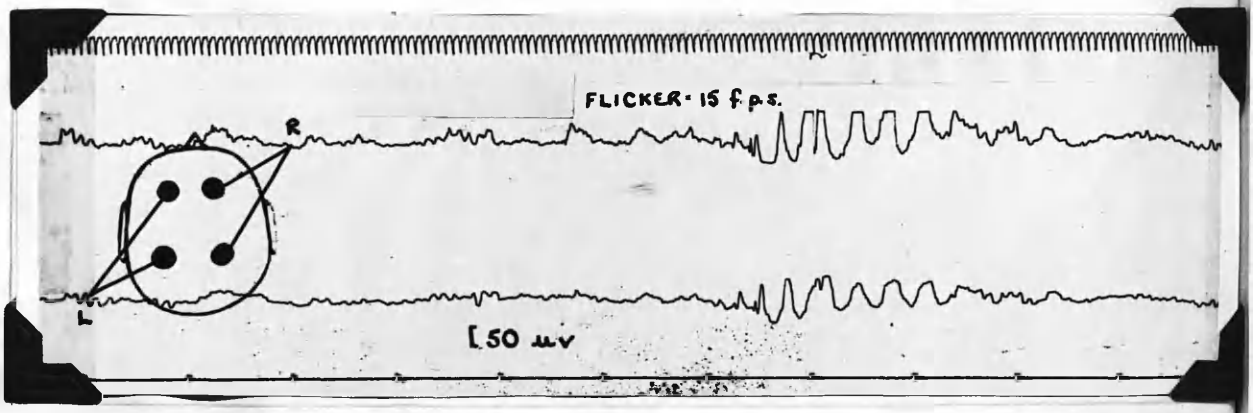
Description of attacks: He felt weak and shook all over. At times he lost consciousness. There was no history of tongue-biting or incontinence. These attacks occurred at frequent intervals, and he had one when he witnessed an epileptic having a fit.

On examination: Physical: He was physically healthy. Mental: He was a very tense, anxious person, but otherwise showed no mental abnormality.

Special investigation: EEG: The resting record was normal. Photic stimulation produced no change, but the injection of 400 mgm. metrazol produced a syncopal attack accompanied by a high voltage delta activity at 2 c.p.s. which was generalised.

Progress: It was considered that his attacks were due to anxiety. He was given superficial psychotherapy as an out-patient until April, 1950, when he had improved somewhat and was discharged.

Diagnosis: Anxiety state.



G.J.J:- Bilaterally synchronous, atypical, spike and wave activity produced by photic stimulation at 15 flashes per second after the injection of 420 mgm. metrazol.

Mr. J.G.J. (17) 23.5.50.

Reason for referral: The investigation of life-long enuresis.

Family history: His maternal grandmother was an alcoholic.

Personal history: He was a nervous child, who was afraid of the dark and suffered frequently from nightmares. He had a fair record at school, and subsequently found employment as a saw-sharpener.

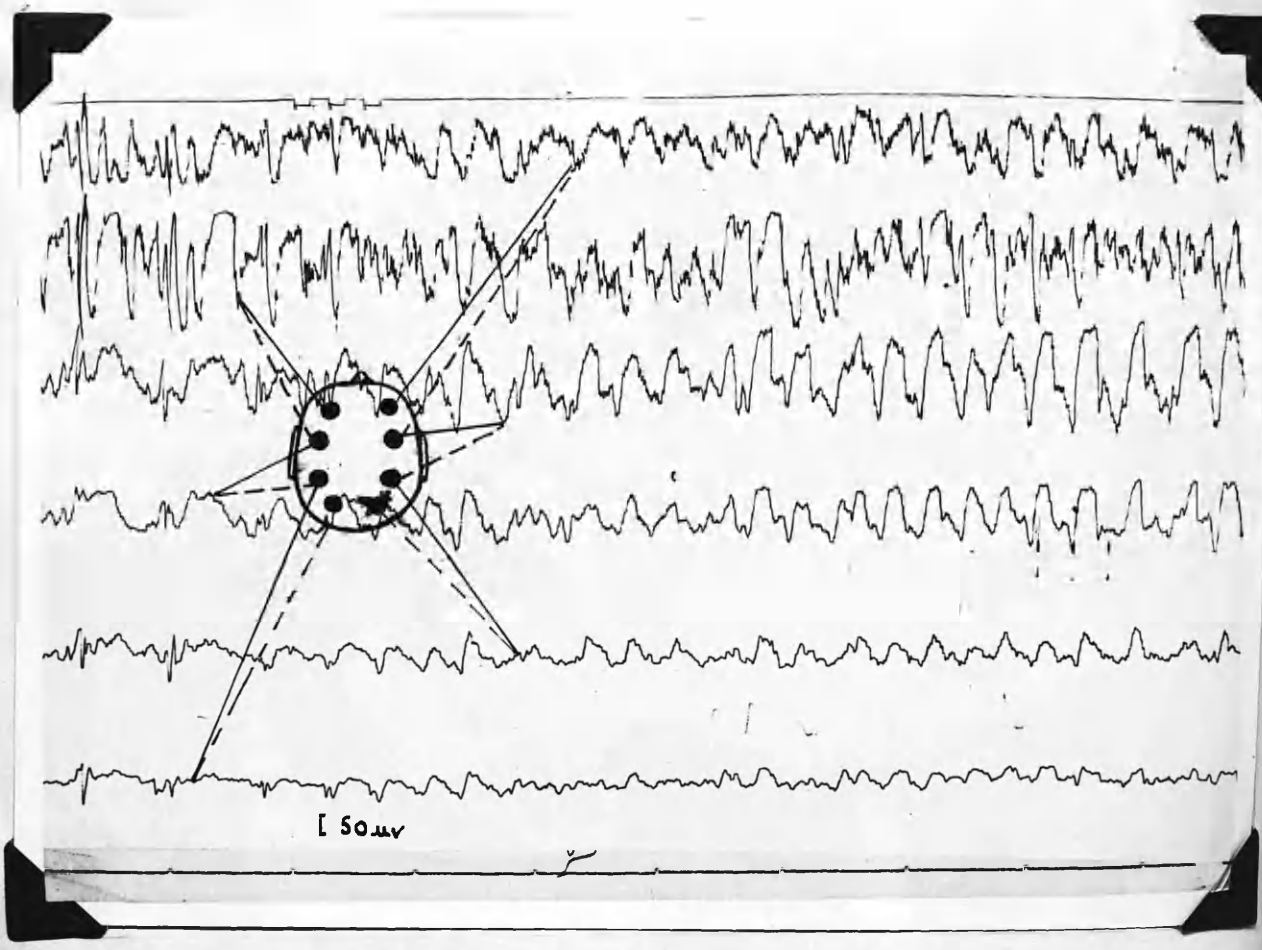
Previous personality: He was a fairly sociable boy, who was inclined to be sensitive.

History of present illness: The patient had suffered from nocturnal enuresis for as long as he could remember. When he was fourteen, he was referred to Lewisham Hospital, where an intravenous pyelogram showed no abnormality, but an x-ray of spine demonstrated that he had a spina bifida occulta. Cystoscopy revealed the presence of a urethral polyp which was fulgurated without any change taking place in his enuresis. Later, he was given a course of ephedrine therapy, but no success was achieved. Occasionally, he had transient feelings of unreality.

On examination: No physical or mental abnormality was noted.

Special investigations: W.R. - Negative. Intelligence - Wechsler full-scale I.Q. 106. The resting record of his EEG. was within normal limits. Photic stimulation produced no change, nor did the injection of 420 mgm. metrazol, but a burst of bilaterally synchronous spike and wave activity was produced by the further application of photic stimulation at 15 f.p.s.

Progress: This response was considered to be of a borderline nature, and he was treated further with amphetamine sulphate, but no improvement occurred in his condition. Afterwards, he was given a course of superficial psychotherapy, and his enuresis disappeared when he began to have an adolescent love affair.



M.L:- High voltage frontal spikes initiating seizure discharge after injection of 150 mgm metrazol.

Mrs. M. L. (25) 24.3.49.

Reason for referral: She complained of headaches, of being troubled by the vision of a woman in black, and by nightmares, all during the past three years.

Family history: Her father deserted her mother when patient was three months old. Her twin brother suffered from epilepsy between the ages of five and fourteen years.

Personal history: She was a premature baby, but thrived fairly well. The only obvious neurotic trait in childhood was stammering. She was educated at an elementary school from the age of five to fourteen. After leaving school, she worked as a tailoress for four years, and then joined the A.T.S. in which she served for a further four years, chiefly as a dental assistant. In 1946, she was invalided from the Service as a schizophrenic.

Sexual development. Menses began at the age of fourteen. They became irregular in 1946, and had remained so. She married in September, 1947, but had had no children.

History of previous illness: In December, 1945, she had an attack of functional aphonia. By January, 1946, an anxiety state had been diagnosed, and admission to Shenley Hospital had been advised. There, her condition was considered to be reactive to domestic worries. A course of continuous narcosis was given, but was followed in four days by a state in which she experienced visual and auditory hallucinations. In February, 1946, she was transferred to Northampton with a diagnosis of agitation, acute hallucinoses and photophobia. E.C.T. was given without effect, and in two months' time she improved spontaneously. In June, 1946, she was invalided from the A.T.S. with a diagnosis of schizophrenia. There was nothing further of note until March, 1947, when she began to walk and talk in her sleep, and experienced also visual hallucinations. Subsequently, in October, 1947, one month after her marriage, she was admitted to Brentwood Mental Hospital. There she was described as being aggressive, childish and violent. She had visual hallucinations in which she saw a woman in black. Severe photophobia was experienced as well.

By January, 1948, she had recovered sufficiently to be sent home. These visual hallucinations returned in September, 1948, and in December of that year she had to be admitted to an Observation Ward, in a state of excitement, for two weeks.

Previous personality: She was normally a cheerful, sociable person, but was liable to sudden fits of temper.

History /

History of present illness: In her previous illnesses, she noticed that she had a right-sided headache which recurred under emotional stress. In March, 1949, the headaches became increasingly severe, she became very irritable and on 21st March, 1949, she was found on the roof of the London Hospital. She was transferred to an Observation Ward where she was violent on admission. From the Observation Ward she was transferred to the Maudsley Hospital for further investigation. The headaches were considered to be migrainous since they were preceded by depression and anorexia, and were associated with a swelling over the right eye. Teichopsia, nausea, vomiting and hypersomnia occurred also. The hallucination of seeing a woman in black had always occurred in association with a headache.

On examination: Physical: There was no abnormality. Mental: She appeared to have a hysterical personality since discussion of "the woman in black" produced an immediate terror reaction. There was no other abnormality.

Special investigations: W.R. - Negative. C.S.F. - Normal. Skull and Chest X-Ray - Normal. Intelligence: I.Q. Mill Hill 108, Matrices 114. EEG. The resting record was normal. Photic stimulation and seconal gr.3 produced no change. The injection of 100 mgm. metrazol produced symmetrical, high voltage, frontal spikes at 3 cycles per second. These disappeared, but re-appeared after a further 50 mgm. had been injected, increased in repetition rate, and culminated in a major seizure. This record was compatible with a diagnosis of epilepsy.

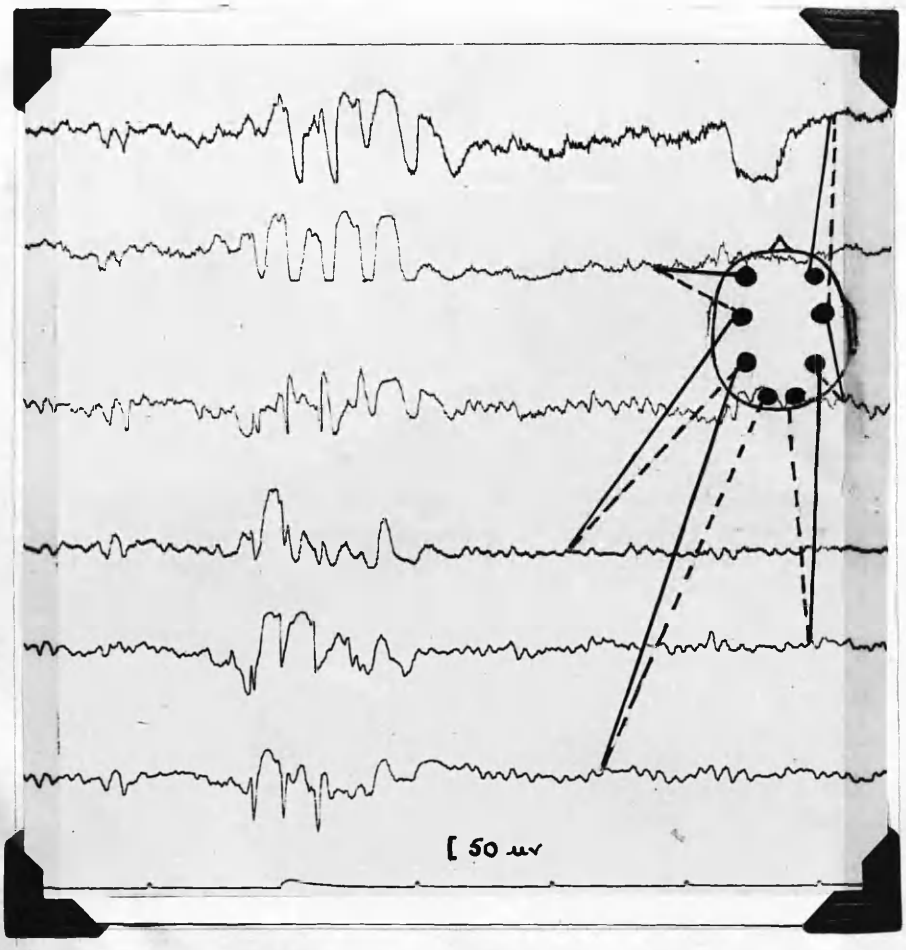
Progress: Subsequently, her behavious alternated between aggressive outbursts and submissive docility. She claimed to have two separate personalities, each responsible for a different form of behaviour. Treatment with anti-convulsant drugs helped in no way. On 18th August, 1949, she became very excited and threatened suicide, so she was transferred to an Observation Ward. A diagnosis of hysterical psychopathy with schizophrenic features was made. Subsequently she was certified, and went to Banstead Hospital, but she recovered sufficiently to be re-admitted to the Maudsley Hospital as a voluntary patient in October, 1949. There her condition fluctuated as before between the extremes of aggressive outbursts and hysterical detachment with amnesia. She was treated by psychotherapy on analytical lines, and in time she improved sufficiently to be discharged to resume normal married life on 22nd June, 1952.

In /

Progress (contd.)

In July, 1952, she saw Mr. Murray Falconer, who thought there was no evidence of temporal lobe epilepsy and that arteriography was not indicated. Two months later, she became actively suicidal, and was admitted to an Observation Ward, where a diagnosis of schizophrenia was made. However, in a week or two she was somewhat improved.

When seen last in December, 1952, she was having occasional attacks in which she appeared to lose contact with her environment. In these she experienced the smell of geraniums. She was well otherwise.



D.W.H.L:-Bilaterally synchronous,atypical spike and wave activity after injection of 200 mgm. metrazol.

Miss D.W.H. L. (20) 25.7.49.

Reason for referral: She was a nurse at Charing Cross Hospital. She had attempted to strangle another nurse, and then had tried to kill herself.

Family history: There was no relevant history.

Personal history: She was slow in her development, and did not walk until she was two years old. She was a shy, nervous child who was subject to frequent headaches. Her educational record was average. After leaving school at fourteen, she became a telephonist, and at the age of eighteen she began to train as a nurse. The menarche was at age thirteen, her menses were very irregular and she had had a six months' period of amenorrhoea, prior to admission to hospital.

Previous illness: At age seventeen she sustained a thrombosis of the central vein of the right retina, from which she had a residual central scotoma.

Previous personality: She was a rather shy, sensitive girl, who felt ill at ease with the other nurses in the hospital who had better social backgrounds than she had.

History of present illness: One evening in July, 1949, the patient felt irritable and tense for no good reason. She felt an urge to kill someone, so she went into the bedroom of another nurse - a girl whom she hardly knew at all - and tried to strangle her. She felt a great deal of pleasure in the act, but the girl screamed so much that many other people came on the scene. Our patient ran out and locked herself in a bathroom. She would have ended her life by jumping from the window, but the bathroom was on the ground floor, so she attempted to drown herself in the bath. However, the bathroom door had been broken down by now and her attempt was foiled.

On examination: Physical - Normal, apart from right central scotoma. Mental - She showed little emotional appreciation of her actions, but there was no evidence of thought disorder.

Special investigations: W.R. - Negative. I.Q. Matrices, 114. EEG. - This showed a slow wave dysrhythmia which was suggestive of psychopathy. Photic stimulation produced no change, but the injection of 200 mgm. of cardiazol produced a burst of bilaterally synchronous spike and wave activity.

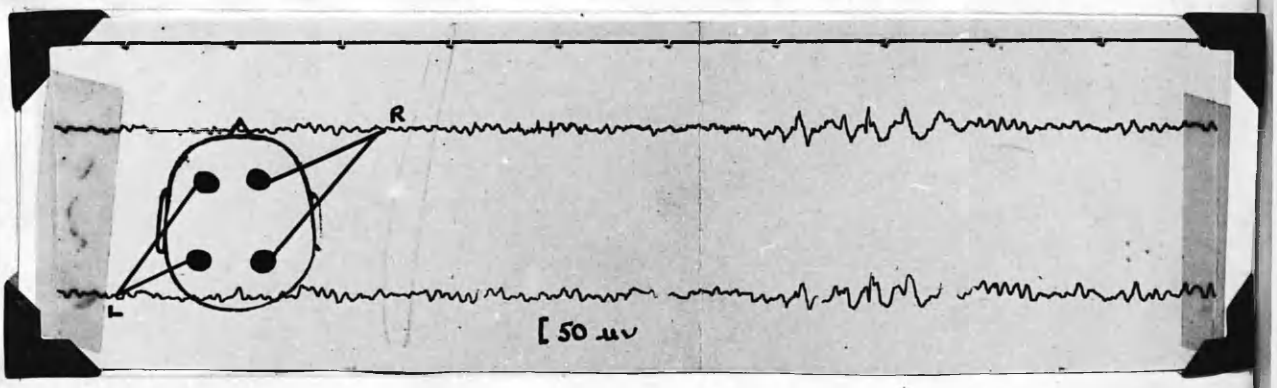
Progress: A diagnosis of hysteria was made. An attempt to treat her by means of superficial psychotherapy was carried out, but she displayed a front of bland indifference which it was impossible to break through. She was discharged on 10th February, 1950. Subsequently, she had several upsets. It proved difficult to find employment, and she was disappointed to discover that a fellow patient with whom she had fallen in love could not marry her because his wife would not divorce him. In April, 1950, she had several hysterical outbursts at an office where she worked. There she was found /

found screaming at an open window for no good reason.

She came up to the Maudsley Hospital for a follow-up visit on 17th May, 1950. After the interview, she went out and attempted suicide by throwing herself under a bus. She was re-admitted forthwith. Subsequently, she had several outbursts of excited behaviour in which she went around smashing crockery and windows. On this occasion, it was thought that an intracranial lesion should be excluded, and she was referred to Maida Vale Hospital for Nervous Diseases. There, an air encephalogram showed no abnormality.

She was discharged finally from hospital with a diagnosis of aggressive psychopathy.

She was seen last in November, 1950, when she was fairly well, and was hoping to find clerical employment.



E.M.L:- Bilateral high voltage spikes after the injection of 400 mgm. metrazol.

Mrs. E. M. L. Aged: 34 June1950.

Reason for referral:

She gave a history of frontal headaches, which she had had for five years.

There was no relevant family history and her personal history was uneventful.

History of Present Illness:

At intervals during the previous five years she had suffered from attacks of headache, which affected chiefly the frontal region of her head. During these attacks she saw bright lights flashing before her eyes. Occasionally she felt faint during an attack but she never lost consciousness.

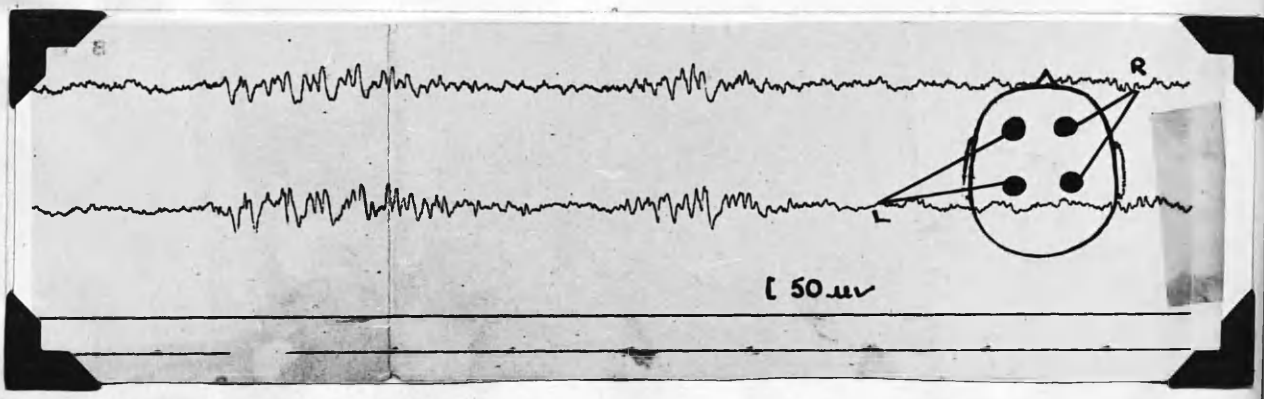
On Examination:

There was no evidence of mental or physical disorder.

Special Investigation:

Skull x-ray was within normal limits.
E. E. G. resting record showed no abnormality.
The use of photic stimulation and of seconal produced no change. However, the injection of 400 mgms. of Metrazol in divided doses, intravenously, over a period of two minutes, produced a burst of high voltage spike activity.

Progress: In spite of the abnormal findings following the injection of Metrazol the patient was not considered to be an epileptic but was thought to be suffering from classical attacks of migraine. This condition was treated with ergotamine tartrate and phenobarbital and the attacks ceased.



F.M:- Bilaterally synchronous atypical spike and wqve activity after the injection of 100 mgm. metrazol.

Mrs. F.M. (47) 2.3.50.

Reason for referral: The investigation of fits which had occurred frequently during the previous nine years.

Family history: Her mother was said to have had convulsions at the menopause, and she had a sibling who died at the age of six months following repeated fits.

Personal history: Apart from hip joint disease at the age of ten, her early life was uneventful. After school, she worked in domestic service until marriage at the age of twenty-one.

Previous illness: She had several fits between the ages of nine and twenty-two. Two years earlier, she had had a hysterectomy for menorrhagia.

Previous personality: She was a rather simple, hard-working country woman.

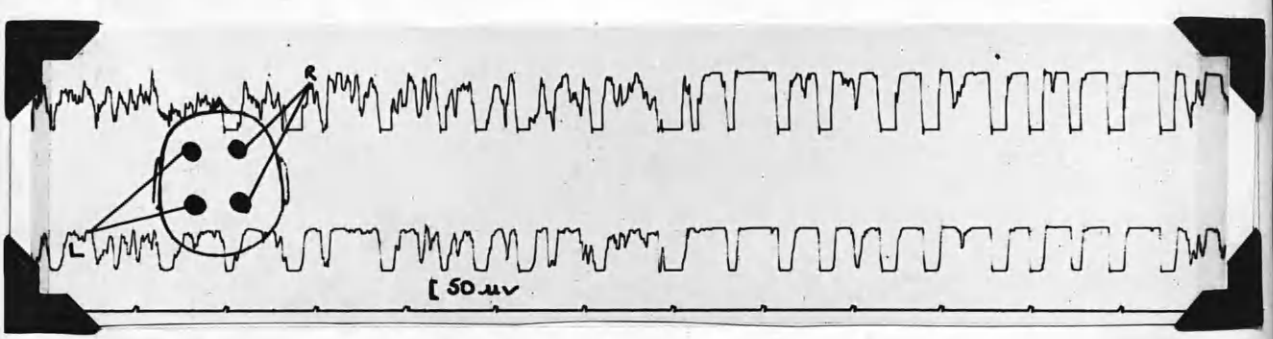
History of present illness: The patient's husband left her when she was thirty-eight. She went home to her mother, and began to have fits at regular, frequent intervals. These responded fairly well to barbiturates, but recently they became more frequent and difficult to control.

On examination: There was no physical abnormality. She was garrulous, and appeared to be of low intelligence.

Special investigations: W.R. - Negative. E.S.R. and Serum Bromide were within normal limits. EEG. - The resting record showed bursts of fast and slow activity. Photic stimulation produced no change, but the injection of 100 mgm. metrazol produced a burst of bilaterally synchronous spike and wave activity. Seconal produced no change.

Progress: The patient was seen to have frequent attacks which were clearly hysterical in nature. Although she foamed at the mouth and produced a great variety of movements, she remained conscious throughout. The cessation of the series of fits coincided with arrangements being made for the care of her four children, who were too much for her.

In view of the EEG. findings, a diagnosis of hystero-epilepsy was made. It was suggested that she should not be treated too energetically with anti-convulsant drugs.



L.P:- Bilateral spike and slow wave discharge initiating major seizure after the injection of 100 mgm. metrazol.

Miss L.F. (14) February, 1950.

Reason for referral: The investigation of a recent history of patricidal impulses.

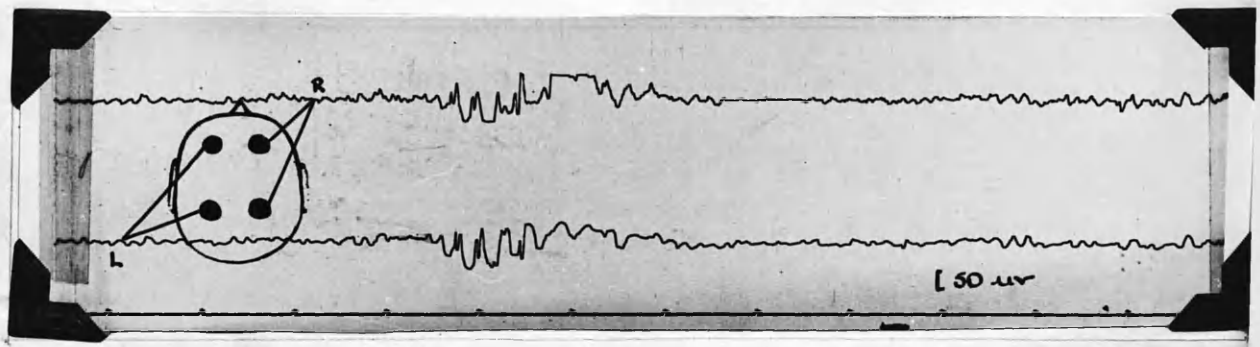
Personal history: Her family had migrated recently from Ireland, and had found some difficulty in settling in London. However, her early life was quite uneventful, and she had had a fairly good school record. She had begun to menstruate a few months prior to her admission .

History of present illness: A short time earlier she had begun to experience fantasies in which she wanted to attack her father and murder him with a knife. She also experienced strong desires to scratch young men with her fingernails. It was noted that these attacks were worst during the days immediately preceding menstruation.

On examination: No physical or mental abnormality was noted.

Special investigations: W.R. - Negative. E.E.G. - The resting record was dominated by slow theta activity. Seconal and photic stimulation produced no change, but the injection of 100 mgm. metrazol produced a high voltage spike and slow wave discharge which terminated in a major convulsion.

Progress: It was not considered that she was suffering from epilepsy, but rather from a behaviour disorder which was related to the onset of menstruation, and thus she was treated by superficial psychotherapy. While she was an in-patient, no abnormality of behaviour was noted, but a few months after discharge from hospital, she was charged with stealing ration books, and was put on probation. Later, she obtained employment as a nursing orderly, but was again convicted of larceny. However, she has still continued to be treated along psychotherapeutic lines, and has remained fairly well.



Miss R.S: Bilateral,atypical,spike and wave activity after the injection of 100 mgm. metrazol.

Miss R.S. (13) 8.6.5[illegible].

Reason for referral: The investigation of fits which she had had during the previous year.

Family history: The father was a patient in a mental hospital, and he was said to be suffering from anxiety hysteria. The mother was an obsessive, over-anxious woman.

Personal history: Her early life was uneventful. Recently, she had failed in a scholarship examination, and had begun to attend a secondary modern school.

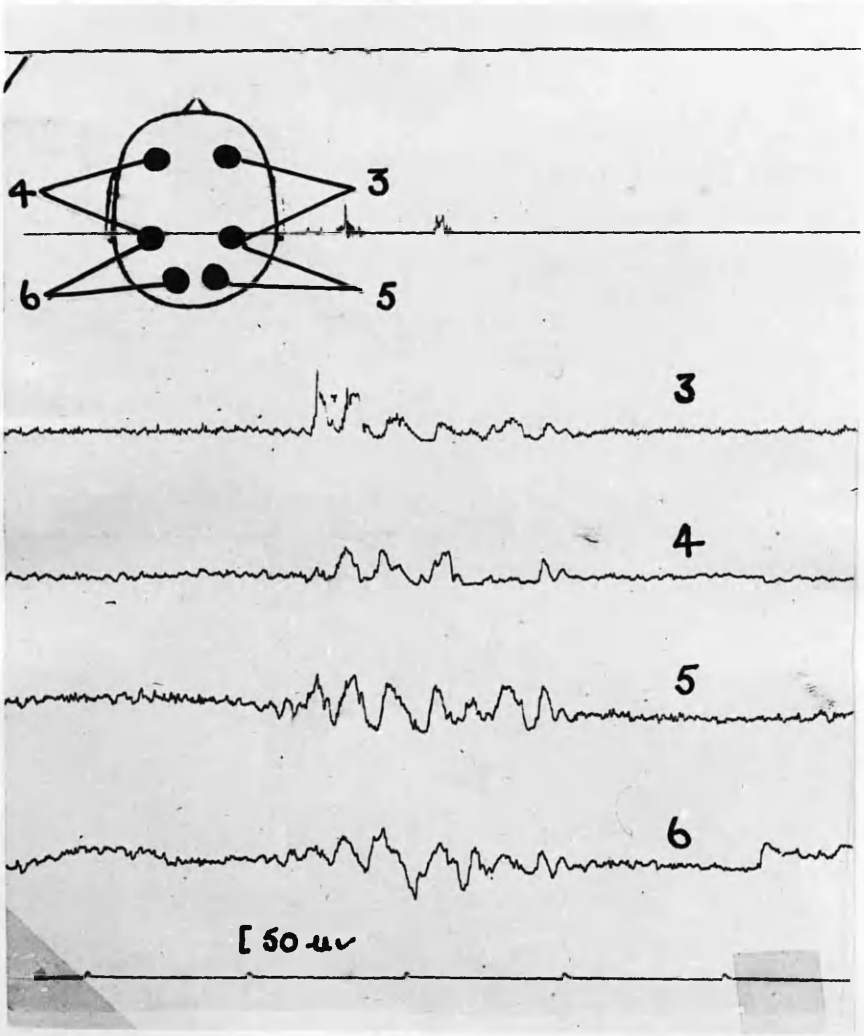
Previous personality: She had been always a fairly happy girl who was very attached to both her parents.

History of present illness: A year earlier she had had a sudden attack of loss of consciousness without convulsions. Six months later, a further attack occurred, and was followed by more fits as frequently as five to six times per day. She was seen in the Child Guidance Clinic, where she was considered to be an epileptic. However, the attacks continued, in spite of anti-convulsant medication.

On examination: There was no physical abnormality, and she was noted to be a bright, cheerful girl.

Special investigations: EEG. - The resting record was normal, even when repeated after a series of fits. Photic stimulation produced no change. The injection of 100 mgm. metrazol produced some atypical spike and wave activity.

Progress: It soon became evident that she was suffering from anxiety hysteria. No fits were seen in hospital, and they occurred only when she was at home with her mother. They appeared to be related to her mother's anxiety and to her father's absence from home. Arrangements were made for her to go to a residential school. She went to one in Yorkshire, and stayed there, free from attacks, until she reached the age of fifteen. When last seen in July, 1952, she had begun clerical work in London, and had remained well. It was thought that no significance should be attached to the metrazol response.



L.C.S:-High voltage slow waves,(bilaterally-synchronous), after injection of 400 mgm. metrazol.

Reason for referral: Investigation of headaches which he had experienced at intervals during the past eight years.

Family history: There was no relevant information.

Personal history: His birth was normal, but he was a very nervous child who was shy, afraid of the dark and who suffered from night terrors. At the age of twelve, he had had "sunstroke" in which he was delirious and experienced photophobia. He did well at school, and since leaving he had worked as a clerk, chiefly in solicitors' offices. He reached the rank of sergeant in the Army, but was invalided out on psychiatric grounds in 1943. Recently, his work had deteriorated, and his income had dropped from ten pounds to five pounds per week. He was married, and had one child, who was nervous. He quarrelled frequently with his wife.

Previous illnesses: These included the following: (i) Head injury with concussion at the age of eighteen; (ii) Malaria at the age of twenty-four; (iii) "blackouts" for which he was invalided from the Army in 1943, and appendicitis in 1949.

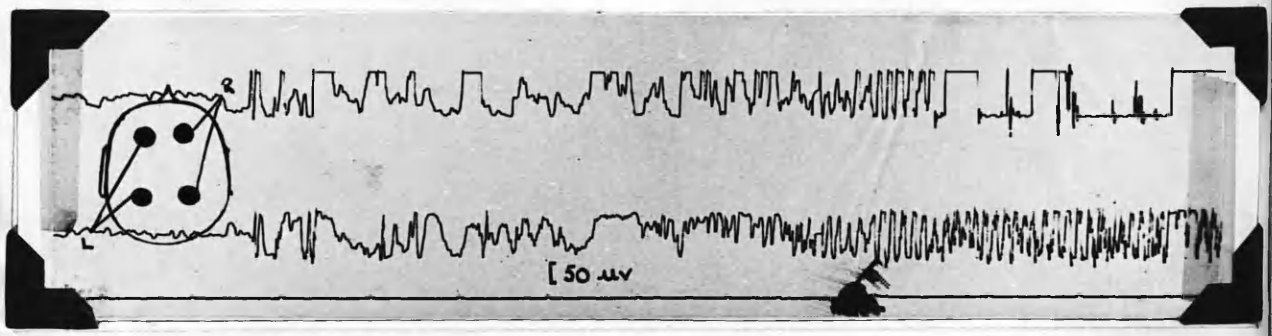
Previous personality: He had always been a capable, active person, but he had been shown to be rather hypochondriacal and prone to develop acute anxiety reactions.

On examination: There was some wasting of the right shoulder muscles; there was increased tone in the right arm; and he had a tremor of the lips and tongue. Mental: He was a garrulous person, who described certain washing rituals which he enjoyed. There was no evidence of deterioration.

Special investigations: W.R. - Negative. E.S.R. 2 mm. Serum Bromide, less than 25 mgm. per cent. EEG. - The resting record was normal, and photic stimulation produced no specific change. However, the injection of 400 mgm. metrazol produced bilaterally synchronous slow waves - a non-specific abnormality. Intelligence (Wechsler Verbal I.Q., 126.

Progress: No serious complaint of headaches was made during his stay in hospital, nor was there any evidence of epileptic attacks. The coincidental appearance of obsessional washing rituals, with wasting of the right shoulder muscles, the increased tone in the right arm and the tremor of the tongue, was rather striking. In view of the history of a febrile illness in childhood, associated with photophobia, diagnosed then as "sunstroke", it was considered most likely that childhood illness had been an attack of polio-encephalitis which had left him with a certain degree of post-encephalitic parkinsonism.

He was discharged on 3rd June, 1950, with the suggestion that amphetamine sulphate medication might help him, but nothing further was noted.



A.E.T:- Onset of major seizure after injection of 280 mgm. metrazol.

Reason for referral: He was referred for investigation of incendiarism for which he had been before the Juvenile Court in July, 1949.

Family history: His mother suffered from attacks of migraine.

Personal history: His birth was normal, but in early childhood he was overactive, wilful and had temper tantrums. He attended a variety of schools, including a residential school for backward children, and he had also spent one year in an epileptic colony.

History of present illness: Since the age of three years, he had had attacks of loss of consciousness associated with drowsiness. He was examined at the Hospital for Sick Children, Great Ormonde Street, where a diagnosis of epilepsy was made, and he was treated with phenobarbitone. No fits were noted after the age of ten, when he returned home from Lingfield Epileptic Colony. However, he was persistently disobedient, moody and obstinate. In the first half of 1949, he lit fires on several occasions, causing a great deal of damage to a school, a garage and other buildings. In July, 1949, he was put on probation on condition that he had psychological treatment, but in December, 1949, he was again before the court, charged with breaking and entering.

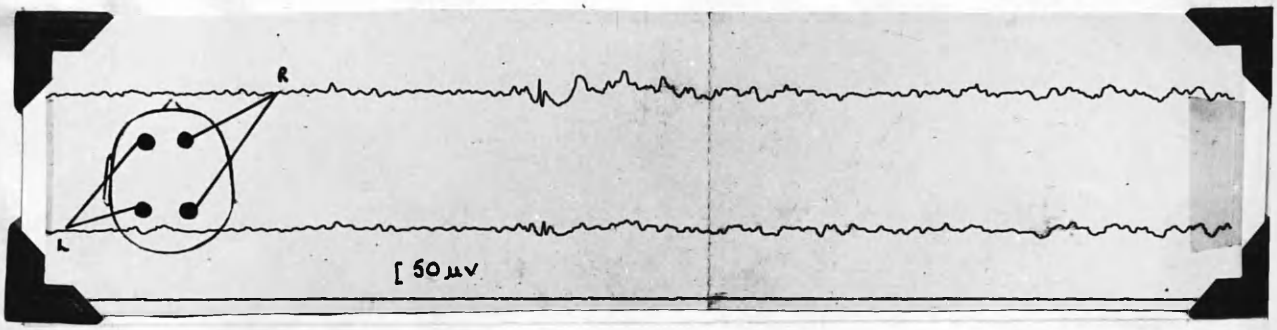
On examination: There was no physical abnormality. Mental: He was a friendly, rather anxious, child.

Special investigations: Intelligence: I.Q. Wechsler, full scale 83. A scholastic test showed him to be educationally retarded. E.E.G. The resting record showed some paroxysmal slow activity. Photic stimulation produced no specific change, but the injection of 280 mgm. of metrazol over a period of 2½ minutes produced a grand mal epileptic seizure.

Progress: He proved to be the type of boy who was easily led, and in the adolescent ward he mixed most easily with the delinquent children. There was no evidence obtained of any psycho-pathological reason for his incendiarism. It was considered that his home was not a suitable environment for him, and arrangements were made to have him deemed maladjusted so that a proper placement could be obtained for him. Unfortunately, his parents refused to allow him to leave home to attend a school for maladjusted children.

In June, 1951, he was charged at a Juvenile Court with a theft of tools, but the case was dismissed. He left school in December, 1951, when he obtained employment in a timber yard, at the receiving end of a circular saw.

In view of the absence of classical epileptic fits, he was not treated as an epileptic, but rather as a behaviour problem in a boy of low intelligence.



E.G.W:- Bilateral spike discharge at onset of major seizure after the injection of 280 mgm. metrazol.

Mr. E.G.W. (35) 21.8.50.

Reason for referral: The investigations of morning headaches and attacks of irritability which he had been having for six months.

Family history: His father had been eccentric, one sister was a patient in a mental hospital, and the other was a psychopath with a mentally-defective child. A paternal uncle had been a mental hospital patient.

Personal history: His early life was uneventful. He had a good school record, but found difficulty in settling down to a steady job. During the war he served in the R.A.F., chiefly in the Middle East, without incident. Recently, he had been working as an insurance agent, but disliked the job. He had been married for ten years, and had been impotent for the first three years of marriage.

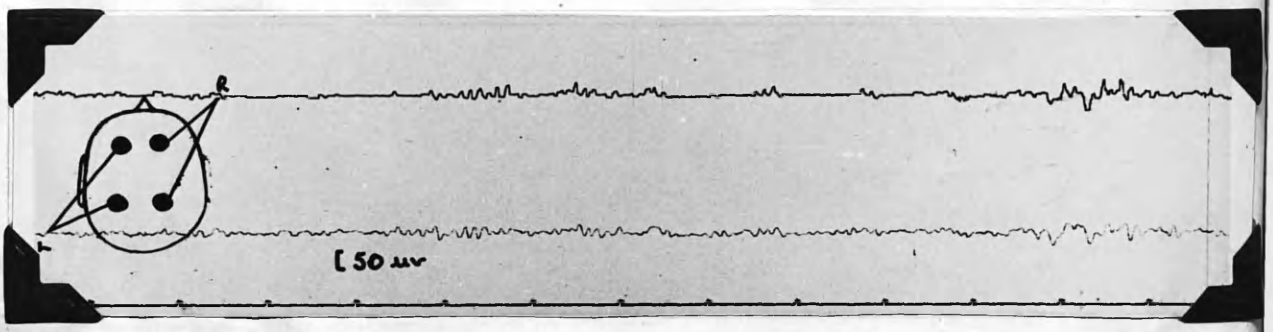
Previous personality: He had been an unusual person, who felt he was different from the common herd.

History of present illness: Six months earlier, he had begun to find his job irksome. The necessary clerical work tired him easily. His eyes ached, he had early morning headaches and behaved irritably towards his wife. He was referred to hospital to rule out the possibility of a brain tumour.

On examination: There was no physical abnormality, but he appeared to be aggressive in his manner.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record showed an excessive amount of slow activity. A record taken in paraldehyde sleep showed no change, and photic stimulation produced no abnormality, but the injection of 280 mgm. metrazol induced a burst of bilaterally synchronous spike and wave activity, followed by a major seizure in which the patient showed semi-purposive movements.

Progress: In spite of these findings, it was considered that he was not suffering from epilepsy, nor was any organic lesion present. A diagnosis was made of an acute anxiety state occurring in a man of psychopathic personality.



R.S.W:- Bilaterally synchronous slow activity after the injection of 350 mgm. metrazol.

Reason for referral: Investigation of blackouts which he had had for the past six months.

Family history: No relevant information.

Personal history: His birth and early development were normal, but he was rather timid and shy as a child. He did well at school, but on leaving at the age of fifteen he falsified his age and joined the Royal Navy, in which he served, principally in submarines, until the end of 1945. Since then, he had been an engineer for an oil company. He had taken up flying, and had qualified as a pilot. He married in 1945, but his wife deserted him, and for the past two years he had been living with another woman by whom he had had a child. This relationship had been complicated by his falling in love with yet another woman.

Previous illness: (i) Two head injuries (shrapnel), 1944-45. (ii) He was depressed in 1945 when his wife left, consequently, he had modified insulin therapy at Sutton Emergency Hospital.

Previous personality: He had always been explosive and unreliable, with a tendency to mendacity.

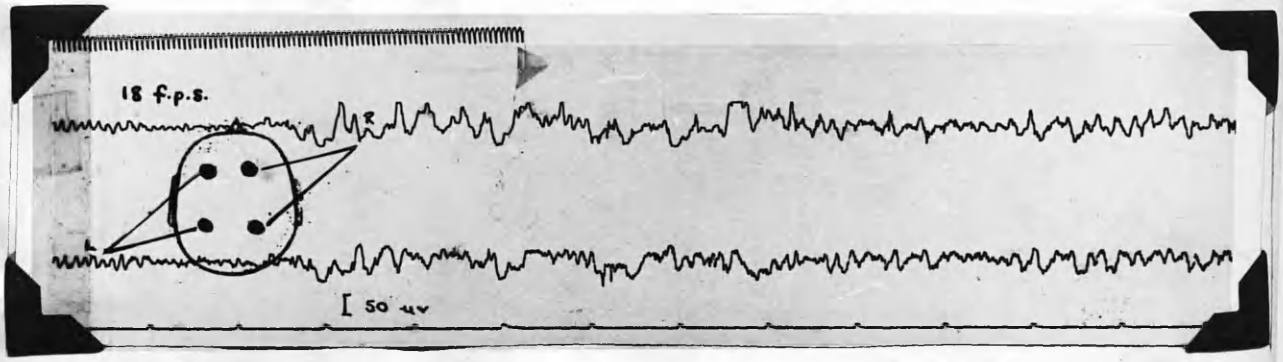
History of present illness: The attacks of blackouts were related closely to the history of his sexual difficulties since October, 1947. He had been depressed, irritable, at times violent, and had drunk excessively. He became increasingly depressed as his love affair began to break up.

On examination: There was no physical abnormality. Mental: He showed a rather shallow affect, with little evidence of responsibility.

Special investigations: W.R. - Negative. E.S.R. - Within normal limits. EEG. - There was a dominant alpha rhythm at 10 cycles per second, with tracks of slower rhythms present. Overbreathing produced no specific change, but the injection of 350 mgm. metrazol produced a burst of slow wave activity which disappeared. 420 mgm. of metrazol was given in all without any further change, but photic stimulation at 15 flashes per second produced a burst of spike activity.

Progress: He was regarded as a man of psychopathic personality, and he was put on a regime of benzedrine mgm.10 omne manu, and sodium amytal gr.3 omne nocte. In the course of his treatment it came to light that the police wished to arrest him for a series of charges of false pretences.

On 19th April, 1950, he was taken into custody by the police, and in May, 1950, he was found guilty on three charges of obtaining credit by fraud. Nothing further was heard of him.



J.E.W:- Onset of major seizure characterised by bilaterally synchronous slow activity. Seizure induced by photic stimulation at 18 flashes per second after the injection of 425 mgm. metrazol.

Mr. J.E.W. (34) 4.4.50.

Reason for referral: He had been charged with the larceny of clothing one month earlier, and had been referred to hospital for psychiatric examination.

Personal history: His early life was normal, and he had had a good school record. At the age of fifteen, he went to sea, but gave this career up at the age of nineteen, and became an electricity-meter inspector, in which occupation he had remained apart from war service in the Royal Navy. He married at the age of 22, was happily married and had two healthy children.

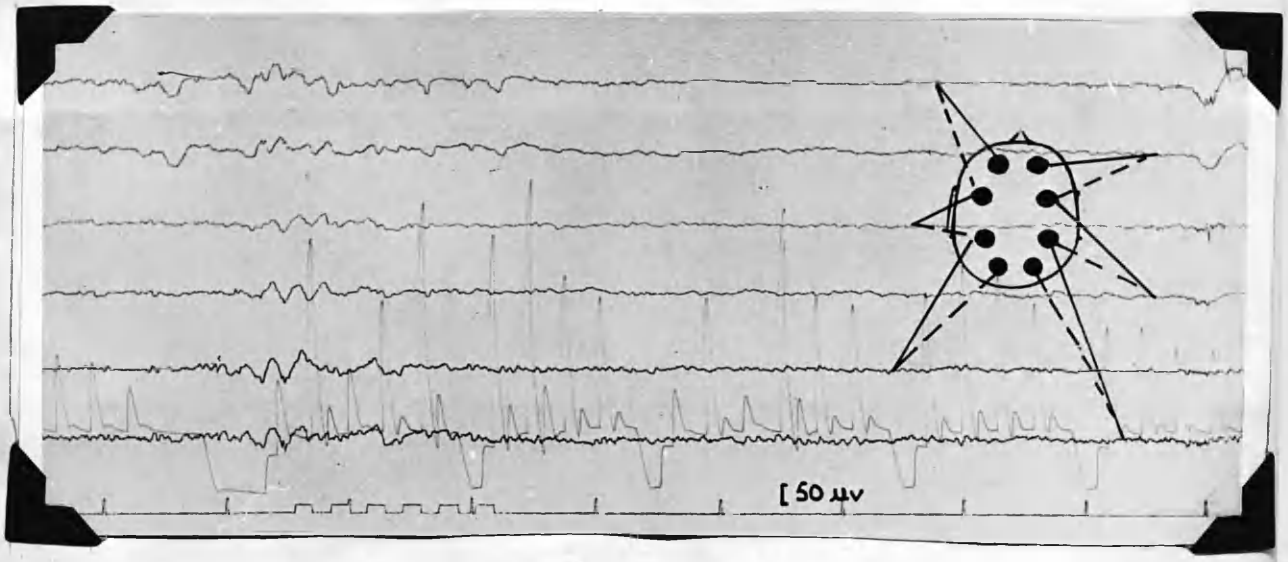
Previous personality: Always he had been a conscientious, hard-working person without any history of instability.

History of present illness: Complaints had been received by the police a few weeks earlier that washing had been disappearing from clothes lines in certain gardens adjoining the patient's home. A watch was kept, he was seen removing washing from a neighbour's garden, and was arrested. On searching his house, several stolen articles of clothing were found in a cupboard. Each was noted to be a garment of female silk underwear. The patient denied all memory of having taken them, although he admitted that he always had had a liking for silk underwear, and when he could afford it, he wore nothing else. He stated that it was his practice, in the evenings, to walk round his garden and smoke a pipe before supper. Although he could not remember doing anything more than that, it seemed likely that he stole the underwear in the course of these strolls.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record showed a slightly excessive amount of generalised slow theta activity. Photic stimulation produced no change, but the injection of 300 mgm. metrazol produced a bilateral synchronous burst of sharp and slow waves. Subsequently, photic stimulation at 18 flashes per second, following the injection of 425 mgm. metrazol, induced the appearance of definite spike and wave activity which was followed by a generalised convulsion.

Progress: In spite of these tests, he was not considered to be suffering from epilepsy, but it seemed likely that he was a fetishist. In the report to the magistrate, his behaviour was attributed to depression as a result of the death of his mother, and he was put on probation, so that he might attend for superficial psychotherapy.



Mrs.L.W.:- Bilaterally synchronous slow activity after the injection of 400 mgm. metrazol.

Mrs. L.W. (50) 30.12.50.

Reason for referral: The investigation of fainting attacks which she had been having for six months.

Family history: Her father was noted for his quick temper, and she had two brothers and three sisters, all of whom were highly-strung.

Personal history: She was a nervous child, stammered and had many mannerisms. She did well at school, and had a good employment record subsequently. She was married, and had one daughter who was highly-strung. The patient had been menopausal for the previous year.

Previous personality: She was a woman of markedly obsessive characteristics, and she was inclined to be upset easily.

History of present illness: During the previous six months, she had begun to have fainting attacks associated with frontal headaches. In these attacks, she slipped gently to the ground, and never injured herself. There was no history of tongue-biting or incontinence. The noise from the refrigerator next door upset her, and she thought that this sometimes precipitated her attacks. About one month ago she became very depressed, and contemplated suicide. For this reason, she was admitted to hospital.

On examination: There was no physical abnormality. She was a tense, anxious woman, who showed some evidence of depression.

Special investigations: Skull-X-ray was normal. EEG. - The resting record was within normal limits, photic stimulation produced no change, but the injection of 400 mgm. metrazol produced a brief discharge of bilaterally synchronous slow activity.

Progress: In view of the lack of positive evidence of epileptic phenomena, it was considered that she was suffering from a mixed depressive-anxiety state of menopausal type. Treatment consisted of modified insulin therapy, and the use of stilboestrol. On this regime, she improved rapidly, and had no further recurrence of her symptoms.

This section contains the histories of a group of patients who were thought to be suffering from epilepsy initially. The use of the provocative methods evoked no epileptiform abnormalities and in the light of their subsequent progress their diagnoses were revised.

Mr. K.A. (19) January, 1950.

Reason for referral: He had a recent history of temper tantrums.

Family history: The patient's father was subject to mood swings. His maternal grandfather and a maternal aunt died in a mental hospital.

Personal history: His early life was uneventful. He was educated at a trade school where he was a poor pupil, then he went into the building trade.

Previous personality: He was an unusually shy, quiet and nervous child. At times he was quick-tempered and self-willed.

History of present illness: In the autumn of 1949, it was noted that he was alternately quiet and excited. When excited, he became violent, was over-talkative and could not sleep. At these times he felt that his parents were against him.

On examination: There was no physical abnormality, but he showed pressure of talk, and was rather hypomanic in his manner.

Special investigations: Intelligence: Wechsler, full-scale I.Q. 101. EEG. - The resting record showed an excess of fast and slow activity. Photic stimulation and the injection of 400 mgm. metrazol produced no change. Seconal produced no abnormalities.

Progress: He was not considered to be suffering from epilepsy, and soon after he entered the Army, in which he served until June, 1952. Of this time, about one hundred days were spent in detention for insubordination. On discharge from the Army, he went into the furniture trade. In the autumn of 1952 he became restless and excited. He stayed out at night, and could not concentrate on his work. Finally, he became unmanageable at home, and was admitted to the Maudsley Hospital in November, 1952. There he became more excited, and after six days it was found necessary to transfer him to an Observation Ward.

Mr. A.J.A. (23) 28.11.49.

Reason for referral: The investigation of violent outbursts of temper which he had had for two years.

Family history: His maternal grandmother and his younger sister suffered from epilepsy. A cousin suffered from manic depressive psychosis.

Personal history: His early life was uneventful, but his work record was poor, and since leaving the Army (A.1) in October, 1947, he had done little.

Previous personality: He was an indecisive, undemonstrative young man.

History of present illness: At the end of 1947, he began to have violent outbursts of temper, without any reasonable provocation. In August, 1948, he entered Brentwood Mental Hospital as a voluntary patient. A diagnosis of schizophrenia was made, and he had a course of E.C.T. This made him a little better, but he was violent at times and had several "black-outs" which were not thought to be epileptic in nature. Since his discharge in July, 1949, he had continued to have violent outbursts of temper and attacks of dizziness.

On examination: No physical or mental abnormality was noted, other than the fact that his affect was shallow.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. Intelligence: Matrices I.Q. 126. EEG. - The resting record was normal, and photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: It was considered that he was not epileptic, and that the best way to help him was to arrange for him to live in an environment as free from irritations as possible. He was advised to live away from home, and training in draughtsmanship was arranged. In July, 1951, he was seen after he had attempted suicide by the use of barbiturates. This followed on a long series of frustrations. Methedrine was prescribed, and when seen a year later he was very much more stable on this regime.

Mrs. L.E.A. (30) 24.1.49.

Reason for referral: Investigation of complaint of attacks of depersonalisation, depression and headaches.

Family history: Her father was highly strung, and had several nervous breakdowns. An elder sister was certified and treated for religious mania in 1948, with insulin and E.C.T.

Personal history: She was born and brought up in South Africa. She had night terrors, was enuretic and walked in her sleep as a child. She had smallpox at age 12. She was educated at convent schools. Since the age of 18, she had worked in England as a governess, a mannequin and during the war as a V.A.D. She was married, and had a good relationship with her husband.

Previous illness: In 1942, she fell from a bicycle on to her head, but had no concussion. In June, 1945, she had a nephrectomy for hydronephrosis. The other kidney became infected, and she had three periods in hospital as a result of this. She had always had headaches which were aggravated by the smell of cigars.

Previous personality: She appeared to have been an emotionally unstable person.

History of present illness: She became depressed after her operation in 1945. This depression continued without relief. In 1947, she had a transient left hemiparesis, and nearly a year later, in 1948, she had her first attack of depersonalisation. She was examined at the National Hospital for Nervous Diseases, Queen's Square. There a diagnosis of epilepsy, characterised by uncinate attacks associated with feelings of depersonalisation, was made.

On examination: There was no physical abnormality of note. Mental: She showed an excessive degree of emotional activity, but was otherwise normal.

Special investigations: W.R. Negative. E.S.R. 9 mm. Urine: N.A.D. Intelligence: I.Q. Matrices 114. EEG: The resting record showed no specific abnormality. Photic stimulation, seconal gr. 3, and the injection of 400 mgm. metrazol produced no epileptiform changes.

Progress: A diagnosis of depression associated with depersonalisation was made. She was given a course of superficial psychotherapy on which she made a reasonably good recovery. It was noted subsequently that she had given birth to a still-born child in August, 1950, and that nine days later she had been admitted to a mental hospital.

Mrs. E.A.B. (38) 20.7.48.

Reason for referral: She complained of headaches and fainting attacks of recent origin.

Personal history: She had had a normal childhood, and did well at school. After leaving school, she had a fairly stable work record as a factory hand. She married at the age of twenty, and had three children. Her husband died as a result of war wounds in 1946. She remarried, a widower, in 1947, and had had a rather unhappy time with him.

Previous illness: She had had a minor nervous breakdown during the war, but this cleared when her mother-in-law left the home.

History of present illness: There had been increasing friction since the second marriage, in which she had had another child. She had left her husband several times. He complained that she was over-sexed. When first seen in out-patients in July, 1948, it was considered that she had a hysterical personality, and that her attacks were due to social stresses. Early in 1949, she began to have blackouts. She had some warning - for two to three days before an attack she felt irritable, and complained of occipital headache. Then, in the attack, she would fall down without any warning. On recovery, she always had a severe headache. There was no history of tongue-biting or incontinence, but she sustained bruises in her falls.

On examination: There was no physical abnormality: Mental: She gave a good account of herself, and there was no evidence of deterioration. She appeared to have a hysterical personality.

Special investigations: The resting record showed some paroxysmal slow theta activity and some doubtful sharp waves. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: It was considered that she was suffering from a neurotic depression with hysterical features, and that the precipitating factor was her second marriage. She was offered treatment as a voluntary patient at a mental hospital, but this she refused. She was advised further to leave her second husband and to live with relatives, if possible.

Mr. E.D.B. (28) 14.11.49.

Reason for referral: The patient got into difficulties with the law for an alleged sexual offence. He had practised sexual perversions for several years.

Family history: Both parents were highly strung.

Personal history: Patient was born with the aid of forceps. He developed normally, but he had many neurotic traits such as bed-wetting, sleep-walking and nail-biting up to the age of ten. He was educated at various schools from the age of five to nineteen, but was never very happy. He went to Cambridge for two years. A further two years were spent in the Army, but he made a poor adjustment to Army life and was discharged on psychiatric grounds in 1943. Subsequently, he took employment in film studios, and since 1948 he had been press receptionist for a large London theatre. The patient had always been preoccupied with sexual matters. Circumcision at the age of four upset him considerably. The opposite sex had never attracted him, and as a child he played girls' games. He had found sexual gratification in fellatio with other men, by eating and drinking excreta, by pornographic photography, by caning and by exhibiting himself publicly.

Previous personality: He was an obsessive, highly-intelligent man, who was well versed in many subjects and who was a very sociable person.

Previous illness: He had suffered from urticaria and hay fever for many years. He had one previous conviction for exhibitionism.

History of present illness: The patient had a homosexual affair with an American soldier who introduced him subsequently to a U.S. Army sergeant. In July, 1949, he took them both to Brighton for a weekend, but the sergeant went only in order to obtain evidence against the patient. At the sergeant's instigation, a search warrant was issued, and the patient's office was searched by the police. Evidence was found in the form of pornographical literature and certain compromising letters. At this point, the patient sought medical advice, and his admission to hospital was arranged.

Examination on admission: He was a physically well-developed man. Mental: He talked and behaved in a feminine way. There was marked evidence of anxiety, but there was no thought disorder, and he was not depressed. He described his tendency to sexual exhibitionism as an uncontrollable impulse.

Special /

Mr. E.D.B. (Contd.)

Special investigations: W.R: Negative. Intelligence: I.Q. Matrices 140. EEG: The resting record was within normal limits. Photic stimulation, seconal gr.3, and the injection of 400 mgm. of cardiazol produced no specific change.

Progress: He was put on probation with the recommendation that he was to have psychiatric treatment. In view of the absence of epileptic phenomena, no anti-epileptic treatment was indicated. Therefore, he was referred to a psychotherapist in whose care he continued, after his discharge from hospital. Stilboestrol was used in an attempt to reduce his libido, and a slight improvement was noted.

A final diagnosis of homosexuality was made, when he was discharged on 24.10.50. Supportive psychotherapy was continued until April, 1951, when he was considered to be well enough to need no further medical assistance.

Mr. D.B. (29) 2.12.48.

Reason for referral:
He complained of attacks of dizziness since 1940.

Family history. There was no relevant information.

Personal history: His early life was uneventful. He left school at the age of fourteen, and worked as a butcher until he went into the Army in 1939. He was captured in France in 1940. After discharge from the Army in 1945, he returned to his former occupation as a butcher.

History of present illness: In June, 1940, when a prisoner-of-war, he was knocked down by a motor cycle and was unconscious for one day. There was no fracture of the skull. Many months after the original injury, he developed attacks of unconsciousness which were aggravated by exertion and excitement. They were followed by nausea, but he had no headache. After repatriation in April, 1945, he was posted to an Infantry Regiment, where his attacks became frequent, he broke down and was invalided out of the service with a diagnosis of hysteria. Subsequently, he attended the Maudsley Hospital Supportive Clinic as a pensioner. He described attacks in which he flushed all over and felt faint. These attacks were precipitated by anxiety such as arose when he had to deal with difficult customers in the butcher's shop where he worked. He also had attacks of claustrophobia, and was unable to travel by underground. There was no history of tongue-biting, incontinence or of any true loss of consciousness.

On examination: There wasno physical abnormality. Mental: He appeared to be extremely anxious, and was still having dreams of "battle experiences" in which bullets whizzed past him.

Special investigation: The EEG, at rest, contained a fair amount of slow theta activity which was more prominent on the right side than on the left. The use of photic stimulation, seconal and the injection of 400 mgm. of metrazol produced no specific change.

Progress: A diagnosis of hysteria was confirmed. It was found that the patient was helped best by a combination of barbiturates and amphetamine sulphate.

Miss D.B. (39) 13.3.50.

Reason for referral: A history of fainting attacks which she had had since childhood.

No other relevant history was obtained.

Description of attack: Her fainting attacks began very suddenly. Without knowing how she got there, she found herself lying on the ground. There was no true loss of consciousness, and she experienced no incontinence. On examination, no abnormal physical signs were found.

Special investigations: Skull X-Ray - Normal. EEG. - The resting record showed some low voltage slow theta activity, but photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: This patient was not treated as an epileptic subsequently.

Miss J.B. (28) 28.11.49.

Reason for referral: Investigation of attacks of excitement which occurred during the past six months.

Family history: There was no evidence of any relevant information.

Personal history: Her birth and early development were normal, apart from the fact that occasionally she talked in her sleep and vomited when excited. She was happy at school, but had to leave school at the age of 15 because of frequent attacks of asthma. She has worked chiefly as a shorthand-typist, but served in W.A.A.F. for four years, and was invalided out with asthma.

Previous personality: She had always been an active, sociable individual.

History of present illness: Six months ago, after the death of her grandmother, she became excited, and imagined that she could find her boy-friend a job as personal assistant to a millionaire. This led them on several pointless but fantastic journeys in which she hoped to contact the millionaire. In June, 1949, she fell from a taxi and sustained only superficial injuries. She received £160 in damages, but this was dissipated in a few weeks. Finally, she was admitted to a hospital at Shanklin, where it was noted that she was excited and confused. Her transfer here was then arranged.

On examination: There was no physical abnormality. She was confused, and her talk was rambling in nature. There was evidence that she was depressed and that she had a marked degree of amnesia for the events of the previous six months. There was no sign of any intellectual impairment.

Special investigations: W.R. negative. C.S.F., Skull X-ray and Serum bromide were all within normal limits. Intelligence - Matrices, I.Q. 100. EEG. - The resting record showed excessive slow wave activity, especially on the left side. However, photic stimulation, the administration of seconal and the injection of 400 mgm. cardiazol failed to reveal any abnormality.

Progress: Five days after admission to hospital, her amnesia disappeared, and she stated that she had behaved in this abnormal way only in order to appear to be a more important person than she was. A final diagnosis of hysteria was made.

Mr. A.A.B. (21) May, 1950.

Reason for referral: He had had attacks of dreaminess since the age of eighteen.

Family history: There was nothing relevant.

Personal history: His birth was normal, but he was enuretic to the age of ten. He had asthma at the age of two, and was troubled later by a facial tic, from which he recovered without treatment. He had an elementary and technical school education, from which he obtained employment as a draughtsman. Recently, he lost his job through increasing incompetence.

Previous personality: He was unusually reticent and shy.

History of present illness: When he was studying for an examination at the age of eighteen, he began to have blank spells. These became less frequent when he was put on epanutin and phenobarbitone, in spite of having a normal electroencephalogram. Recently, he had become restless, irritable, and his mother had reported that he laughed and grimaced to himself.

On examination: No physical abnormality was found. Mental: A rather slow, dull young man. There was no evidence of any deterioration or of any thought disorder.

Special investigation: W.R. Negative. B.S.R. - 2 mm. Skull X-Ray - N.A.D. EEG. - Within normal limits. Photic stimulation and the injection of 400 mgm. of metrazol produced no change, nor did the use of seconal.

Progress: Further investigation revealed no further material, but in view of the fact that he remained aloof, suspicious, shy and preoccupied, he was considered to be suffering from schizophrenia. He was very apprehensive of all forms of physical therapy, and it was decided that he should be encouraged to find a job within his capacity.

When last seen in May, 1951, he was having attacks only on rising in the morning. These occurred three times per week.

Mr. H.S. (28) 23.3.49.

Reason for referral. He complained of feeling irritable and tired. He was depressed, and his sleep had been poor ever since his discharge from the Army in 1944.

Family history: His mother had been a patient in a mental hospital.

Personal history: He was born in Essex, where he was brought up by his father. At school, he was a good scholar, but did little useful work after leaving school until he joined the Regular Army at the age of 16. He enjoyed it. He married at age 24, and got on well with his wife. They had two children, one of whom died from gastro-enteritis.

Previous personality: He was an overbearing, over-confident, "cocky" individual.

History of present illness: He broke down, in the Army in 1943, and was treated at Netley Hospital, apparently for paranoid schizophrenia. He was discharged from the Army in 1944, and drifted aimlessly from one job to another. He was miserable and depressed, on the whole. He got a job as a house-painter, an occupation in which he felt reasonably happy, but in 1949 he became convinced that plain clothes policemen were shadowing him at the instigation of the Maudsley Hospital. He was considered to be hallucinated also. In March, 1949, he was admitted to Belmont Hospital, Sutton, where he had a course of 29 insulin comas, after which he felt greatly improved. He was discharged in June, 1949, and returned to the care of the Maudsley Hospital Out-Patient Department. In March, 1950, he complained of headaches and blackouts. In these attacks, he found himself sometimes on the floor, without knowing how he got there. There was no loss of sphincter control. His mind went blank, and he could not hear words for a few seconds.

On examination: There were no physical abnormalities, but he appeared to be somewhat suspicious.

Special investigations: W.R. Normal. Full blood count - within normal limits. No basophil stippling was seen. EEG. Normal. Photic stimulation and the injection of 400 mgm. metrazol in divided doses produced no change.

Progress: Once the diagnosis of epilepsy had been excluded, he continued to receive supportive treatment as an out-patient. He continued to complain of being irritable, and felt that people were watching him. He became depressed from time to time, but did not complain further of blackouts. He was considered eventually to be a mixed schizophrenic and manic depressive state.

Mrs. M.A.C. (33) 4.10.49.

Reason for referral: Investigation of fits which developed since a head injury in April, 1948.

Family history: Her father left the home when she was six years old.

Personal history: Her birth and early development were said to have been normal. She had had an average school record, and subsequently worked in domestic service for four years. She trained as a mental nurse from the age of eighteen, and gave up this occupation on marriage at age twenty-nine. She had a child at age twenty-two. This child was illegitimate because her fiance was killed in a road accident. The child was of subnormal intelligence, and was at a residential school. When aged twenty-nine she married a widower of forty-seven, who had two children. Two more children had been born since the marriage.

Previous personality: A sociable person, who was of a fairly cheerful disposition.

History of present illness: In April, 1948, she tripped on a broken pavement, fell and injured her head. On examination at St. James's Hospital, Balham, no abnormality was found, but since the accident she had fallen without warning two to three times per week. There was no evidence of muscle twitching, tongue biting or incontinence in the attacks. Each attack was said to last for three or four minutes, and she was confused for a brief period afterwards. Recently, she had taken an action for damages against the authority responsible for the pavement. She was offered compensation, which she considered inadequate.

On examination: There was no physical abnormality. Mental: She was a fairly rational person, who showed a certain amount of indifference to her symptoms. There was no sign of deterioration.

Special investigations: W.R. - Negative. E.S.R. - 2 mm. Serum Bromide - less than 25 mgm. per cent. C.S.F. - Normal. Skull X-Ray - Normal. I.Q. - Matrices 94. EEG. - The resting record was within normal limits; photic stimulation and the injection of 400 mgm. of metrazol produced no specific change. Seconal, gr. 3, produced no epileptic phenomena.

Progress: Subsequently, she had two "fits" in which she was fully observed. Neither of these produced any loss of consciousness, and there was no evidence of any epileptic activity.

A diagnosis of hysteria was made, and the patient was discharged from hospital. When seen last on 30.11.49, her compensation claim had been settled, and she had had no further fits.

Mrs. W. C. Aged: 38

Reason for referral: Neuralgia of the left side of the face, which she had had since the age of 16.

There was no relevant family history and her personal history was uneventful.

History of Present Illness: Since adolescence she had suffered from repeated attacks of pain in the left side of her face. These occurred without any warning and at any time of day. There was no known precipitating factor. Many of the attacks were associated with headache which involved the left part of the cranium, and occasionally the patient experienced sickness and vomiting. From time to time, during an attack, she fainted and fell to the ground, and was unconscious for a very brief interval of time. On no occasion did she bite her tongue or experience incontinence.

On examination- There was no evidence of any physical or mental disorder.

Special investigation: Skull X-ray: was within normal limits.
E.E.G. : The resting record showed no abnormality.
The use of photic stimulation, seconal and the injection of 400mgms. of metrazol intravenously produced no change.

Conclusion: It was considered that the patient showed no evidence of epilepsy and that she was suffering from attacks of migraine for which she was subsequently treated.

Mr. E.N.G. (10) 30.6.49.

Reason for referral: The investigation of temper tantrums which he had had for six months.

Family history: There was no relevant information.

Personal history: His birth was normal, but his development was slow, and he did not speak until he was four years old. He had been always enuretic. At school, he was considered to be backward.

Previous personality: He had been a quiet, timid child.

History of present illness: At the age of eight, he sustained a slight head injury, then his mother was told by a doctor that it might take two years for the ill-effects of a head injury to appear. Eighteen months later, he had an attack of paralysis in both legs, and had to be carried home from school. Since then, he had had frequent temper tantrums, and on one occasion had tried to set fire to his home.

On examination: There was no physical abnormality, and he appeared to be a quiet little boy, who described his symptoms in a calm way.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. Intelligence: Binet I.Q. 91. EEG. - The resting record showed a great deal of slow activity, with some sharp fast activity in the frontal areas. Photic stimulation and seconal produced no specific change.

Progress: After admission to hospital, no temper tantrums were noted. He wanted to stay on in hospital because his parents had been showing excessive favouritism to an elder brother. It was considered that he was suffering from a behaviour disorder, precipitated by a difficult home situation. After discharge from hospital, he was deemed to be maladjusted, and in 1950, he went to a residential school. There he settled down well, and was considered to be a good average scholar.

Master G. C. (10 4.10.49.

Reason for referral: Investigation of blackouts of recent origin.

Family history: The father suffered from idiopathic epilepsy; the maternal grandfather and a maternal aunt were said to be highly-strung.

Personal history: There was no abnormality of his birth, and early development, but he had been always backward at school.

History of present illness: This began after the death of his paternal grandfather, eighteen months previously. He wandered off and was usually found near the grave. His sleep was disturbed, he became solitary and refused to play with other children. Then he complained of dizziness and of things going black. These attacks were precipitated sometimes by sudden movements of the head.

On examination: There was no physical abnormality. He was an active little boy, without any evidence of any gross behaviour disorder.

Special investigations: W.R. - negative. Skull X-ray, negative. Intelligence: Binet, I.Q. 114. EEG. - The resting record showed no abnormality, and none could be induced by overbreathing, seconal, photic stimulation or carotid sinus pressure.

Progress: While he was in hospital, no attacks were observed and no other abnormal behaviour was noted, other than the fact that he was active and noisy.

In November, 1950, a letter from his mother stated that he was very much better. Subsequently, he was considered to be suffering from a behaviour disorder without any demonstrable cerebral pathology.

Mr. G.C.C. (33) 24.1.50.

Reason for referral: Investigation of attacks of irritability which he had had since a head injury in 1939.

Family history was in no way relevant.

Personal history: His early life was uneventful. After leaving school, he worked successfully as a plumber. In 1940 he joined the Army, but was invalided out on psychiatric grounds in 1942. Thereupon he resumed his trade of plumbing. He had been married twice, and had three children.

Previous personality: He was subject to mood swings, but when well, he was a good, active worker.

History of present illness: In 1939, he sustained a left supra-orbital fracture when boxing, and was concussed for some hours afterwards. Subsequently, he became irritable, had sudden outbursts of temper and suffered from an inability to concentrate. When in the Army, he was once found wandering twenty miles away from his billet, without knowing how he had got there. Subsequently, he left the Army with a diagnosis of manic-depressive psychosis. In 1943, his wife died, and after her death he saw her in visions when he was depressed. These occurred when he was half asleep. By 1946, it was noted that he was, at times, paranoid, and imagined that other people were talking about him behind his back. Gradually, his work deteriorated, he became more irritable, and his second wife found him more difficult to live with.

On examination: He had no physical abnormality, but he showed evidence of depression.

Special investigations: EEG. - The resting record had a good dominant alpha rhythm. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of Seconal.

Progress: In view of the negative findings, a diagnosis of cyclothymic personality was made. The patient recovered from his depression spontaneously, and obtained a job as a railway-ticket office clerk.

Reason for referral: The investigation of severe pounding occipital headaches associated with self-injury, which had occurred on six occasions in the previous four years.

Family history: This was not relevant.

Personal history: His birth was normal, but he had many nervous traits in childhood, i.e., stuttering, nail-biting and enuresis until puberty. He was a poor scholar, and played truant to such an extent that he was sent to an approved school until he was sixteen. Subsequently, he did farm labouring, served without incident in the Royal Navy, 1940 - 46, and since the war he had been engaged in the building trade.

Previous illness: He had malaria five times between 1942 and 1944. In 1946 he had a head injury.

Previous personality: He had been noted to have a rather shy, reserved nature. He had never had many friends.

History of present illness: After demobilisation, he felt restless and was unable to stay in any one job longer than two months. Since 1946 he had also had severe, pounding occipital headaches, associated with self-destructive and aggressive thoughts on about ten occasions. These included six in which he became unaware of what he was doing and found later on several occasions that he had cut his left forearm with a razor. These attacks occurred only during the evening, and only when he was alone. There was no evidence that he had ever been incontinent, or bitten his tongue. Following a recent attack, he was admitted to an Observation Ward whence he came to the Maudsley Hospital.

On examination: Physical: He had old and recent linear scars of left forearm and wrist. Mental: He appeared to be a rather anxious person.

Special investigations: W.R. Negative. E.S.R. and Serum Bromide - Within normal limits. Blood film - no malarial parasites were seen. Intelligence - I.Q. Matrices 96. EEG. - The resting record was normal apart from some instability on overbreathing. The injection of 400 mgm. metrazol and photic stimulation produced no specific change, nor did the use of seconal.

Progress: He was treated by a process of hypno-analysis over a lengthy period, and derived some benefit from ventilating old grievances against members of his family. He was found to have a specific reading disability, and was given coaching in reading.

He was discharged with the diagnosis of self-wounding hysteria.

Mr. P.W.D. (36) 8.6.50.

Reason for referral: The investigation of fits of depression and irritability since a bomb incident at Dunkirk, 1940.

Personal history: His early life was uneventful. At the age of thirteen, he joined the Royal Navy, and served until he was invalided out, on psychiatric grounds, when he was twenty-seven. Since then, he has been a ticket collector on the railway.

Previous personality: He had been always a sociable, active person, without any history of mood swings.

History of present illness: In June, 1940, he was working on a lighter at Dunkirk during an air raid. He remembered nothing more until he wakened up in hospital in Liverpool four weeks later. Since then, he had had periodic attacks of depression and irritability which lasted from a few hours to a few days.

On examination: There was no physical abnormality, but he showed a mixed picture of depression and anxiety.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: A diagnosis of traumatic war neurosis in a man of good personality was made. Epilepsy was not considered to be present. An attempt was made to treat him by supportive psychotherapy as an out-patient.

Mr. R.S. (29) 23.1.50.

Reason for referral: The investigation of attacks of dizziness which he had had for the previous three months.

Family history: There was no relevant information.

Personal history: His early life was normal. He had an average record at an elementary school, and worked subsequently as a plasterer. He served in the war as a sapper and a paratrooper without any untoward incident. Since the war, he had found it more difficult to settle down, and had rarely spent longer than two weeks in any one job in the building trade. Recently, he had wanted to start his own business.

Previous illness: He had had frontal headaches since childhood. They had the effect of making him feel very depressed.

Previous personality: Always he had been a most active person, looking for excitement wherever he could find it.

History of present illness: During the previous three months, the patient had had several attacks of dizziness. All were preceded by a severe headache. About a fortnight earlier, he had had a blackout, and was found with a cut over his right temple. He was confused, wept and was very upset. He could remember nothing about what had happened. He had been worrying a great deal about starting a new business, and in addition had been anxious about the possibility of falling from scaffolding in an attack of dizziness.

On examination: Physical: No abnormality was found. Mental: He He appeared to be excessively anxious.

Special investigation: E.E.G. - The resting record showed a mild degree of abnormality in the form of traces of slow theta activity. The use of photic stimulation and the injection of 400 mgm. metrazol produced no specific change.

Progress: It was considered that he was suffering from an acute anxiety state, promoted by his worry over his intended business project. He was advised to give up his present occupation, and to take a much less dangerous situation in the Post Office, which had been offered to him.

Mr. E.F. (28) 28.3.50.

Reason for referral: The investigation of attacks of depression, irritability and of outbursts of temper which he had had since the age of fourteen.

Family history: The father was an epileptic patient who deserted patient's mother when the family was young. The mother served several terms of imprisonment for larceny. She had some illegitimate children, of whom one was a mental defective.

Personal history: His early life was a difficult one, and after his father's desertion, he was brought up in residential schools. At the age of thirteen he went to a naval training ship, but was not considered suitable by reason of his outbursts of temper. Then he found employment as a shop assistant; in 1940 he joined the Army but after a motor cycle accident he was invalided out with a diagnosis of neurasthenia. Since then, he had worked steadily as a heavy lorry driver.

Previous illness: Since childhood, he had been under continuous out-patients supervision at the Maudsley Hospital where he was considered to be a schizoid psychopath. In April, 1947, he felt depressed and persecuted, and was admitted to Belmont Hospital after an unsuccessful attempt as suicide.

Previous personality: He had been always a rather sensitive, unstable individual.

History of present illness: Early in 1950, he began to have attacks of irritability, and he showed a great deal of aggression towards his girl friend. On one occasion, he was seen in the casualty department of the Royal Northern Hospital with a history of having fallen unconscious in the street. When he came along to the Maudsley Hospital, he stated that he was worried because his girl friend was anxious that they should be married - a step he was unwilling to take.

On examination: There were no abnormal physical signs, and he appeared to be a rather dull, schizoid individual.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: The diagnosis of psychopathy in a schizoid individual remained unchanged. He continued to have attacks of irritability, but it was considered that these would clear up in the course of time. No treatment was given other than arranging for him to attend a social club.

Mr. D.W.F. (22) 12.5.49.

Reason for referral: The investigation of headaches and fainting attacks which he had had since 1945.

Family history: A maternal aunt suffered from migraine.

Personal history: His early life was uneventful. On leaving school at the age of fourteen, he worked as a clerk and subsequently served in the Army for three years.

Previous personality: He was a solitary, shy, unhappy person.

History of present illness: He had his first attack while running at the double in an Army route march in February, 1945. He experienced a left temporal headache, felt dizzy and fainted. Since then, he had had recurring attacks, sometimes as many as six per week and at times only once in six months. In the attack, he had a severe left temporal headache, felt sick and experienced a bright flash of light in the left half of the field of vision. Then he felt that he wanted to scream violently, and as he did so he fainted or fell unconscious to the floor. There was no history of tongue biting or incontinence. After each attack he had a dull, frontal headache and felt dazed and sleepy. In 1947 he was examined at the National Hospital, Queen Square, where a diagnosis of migraine and anxiety state was made. Since then, he had been having phenobarbitone gr.2 daily without any noticeable effects.

On examination: There was no physical abnormality, and he appeared to be experiencing a fair degree of anxiety.

Special investigations: EEG. The resting record showed a burst of activity, suggestive of spike and wave in appearance. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: He was considered to be suffering from migraine primarily. Later, he began to experience fairly severe outbursts of temper. This was treated successfully by carbon dioxide abreaction, and when he was seen in October, 1952, he was much better.

Mr. A.P.F. (48) 24.7.50.

Reason for referral: He complained of depression, irritability and noises like a dynamo in his head after being blown up at St. Valery in June, 1940.

Family history: There was no relevant information.

Personal history: There was nothing of note in his early life. He served in the Army from the age of fourteen. After being invalided out of the Army he worked as a temporary clerk in the Civil Service. He was happily married, and had four sons.

Previous personality: He had always been a sociable, cheerful person, with wide interests.

History of present illness: After having been blown up at St. Valery, he suffered from frequently recurring attacks of headaches and depression. He was in hospital for one year before being discharged from the Army in 1941. Then he began to have attacks of unconsciousness, and in 1942 he was examined by Dr. F.M.R. Walshe at Leavesdon Hospital, where a diagnosis of post-traumatic epilepsy was made. In 1944, he was admitted to the Atkinson Morley Hospital, where he had a cisternal puncture which relieved his headaches. A year ago, his symptoms became worse, and he entered Belmont Hospital, where he was treated as a chronic anxiety state, and had ether abreactions plus modified insulin therapy. Recently, his attacks of unconsciousness had become more frequent. In them he lost his sense of awareness for about five minutes after which he became excited and ground his teeth. He had never bitten his tongue or been incontinent. His disability pension amounted to 33⅓ per cent., and he felt that it was insufficient.

On examination: There was no physical abnormality. Mental: He was slightly anxious. There was no evidence of deterioration.

Special investigations: W.R. Negative. Skull X-Ray - N.A.D. Intelligence: Goldstein test showed a picture suggestive of organic deterioration. EEG: The resting record showed no abnormality, and the use of photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: He had no attacks in hospital, although the noise in his head continued.

He was discharged with a diagnosis of hystero-epilepsy.

Mr. K.F.F. (20) 25.5.50.

Reason for referral: The investigation of blackouts which he had had for four years.

Family history: His parents were divorced, and his mother, who earned her living as a night club hostess, was separated from her second husband.

Personal history: His early life was normal, apart from frequent temper tantrums. He was educated at various schools, including an approved school, where he had been committed as being beyond parental control. At sixteen, he joined the Royal Air Force, but was soon invalided out on psychiatric grounds. Since then, he had earned a dubious living as a street trader.

Previous health: He had been in an observation ward three times in the previous eighteen months, following attacks of screaming in the street.

Previous personality: He had been always a plausible person without any ambition, having learnt to live on his wits.

History of present illness: Always, he had been unstable, but his instability had become more marked. A year ago, he had been put on probation for demonstrating with a pistol in a dance hall. Since then, he had complained of frequent lapses of consciousness in which he did things without having any knowledge of what he had done. Recently, he had entertained homicidal ideas directed against his mother. He was frightened by these ideas, since he thought that he might attack her in one of his "blank spells". He sought medical advice, and was admitted for investigation.

On examination: There was no physical or mental abnormality.

Special investigations: W.R. - Negative. Skull x-ray - normal. Intelligence: Matrices I.Q. 98. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: He proved a rather difficult person to have as an in-patient, since he attempted to corrupt the other patients. No epileptic phenomena were observed during his stay in the hospital, and he was discharged with a diagnosis of psychopathy.

Mr. R.G. (16) 9.5.50.

Reason for referral: The investigation of unexplained outbursts of temper.

Family history: The father was an excitable man, and the mother had been operated on for a cerebral tumour five years earlier. She was inclined to be haphazard, vague and forgetful. She was almost blind.

Personal history: His birth was difficult in that he was a twin, and his mother was aged forty, at the time. This resulted in a prolonged labour. There was little information available about his childhood behaviour. He had had two attacks of nephritis at the ages of thirteen and fifteen. Recently, he had fractured his cervical spine in a cycling accident. He was an average scholar, but on leaving school he found difficulty in keeping his jobs by reason of his outbursts of temper.

Previous personality: A rather shy, solitary youth, who appeared to have been always meticulous and conscientious.

History of present illness: When eight years of age, he began to have attacks in which he fell to the floor, and then began to struggle and fight. At the age of ten or eleven, similar bouts of fighting occurred at night, lasting twenty minutes. These were followed by sleep. At this time, he was often slow and confused. He complained sometimes that he saw only half of things. A diagnosis of epilepsy was made at that time, and he was treated for a time with epanutin, without noticeable improvement. On going to work at the age of fifteen, he was bad-tempered, shouted or swore when asked to do anything at home. He became more forgetful, and showed no initiative.

On examination: There was no physical abnormality. He was a shy, aloof boy. His memory lapses appeared to be due to lack of attention, and not to deterioration.

Special investigations: Intelligence: U.S.E.S. Aptitude Test. This showed him to be of average intelligence, with no special disabilities. EEG. The resting record contained a great deal of generalised slow theta activity. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: In time he mixed more freely with the other patients. He discussed aggressive feelings he had towards his father fairly freely. He improved to the extent that his bad tempers vanished, and his visual symptoms disappeared. Work was found for him in the electrical trade. A final diagnosis of anxiety reaction was made.

He had remained well, when seen last in October, 1951, and he was managing to hold down his job with a firm of instrument-makers.

Mrs. V.K.G. (44) June, 1950.

Reason for referral: The investigation of "blackouts" which she had had for many years.

Family history: This was not of relevance.

Personal history: In childhood, she was quick-tempered. She did well at school, and worked subsequently as a dressmaker. At the age of twenty-three, she married a man who was twenty years older than she. The relationship was an unhappy one, and she had sought an outlet by having affairs with other men. She had had a hysterectomy for fibroids at the age of thirty-nine.

Previous personality: She had been always a lively, sociable, warm-hearted person.

History of present illness: For the past twenty years, she had had attacks in which she felt dizzy, and fainted. These were worst at the time of her periods. However, she had been completely free from them during one year, in which she had lived apart from her husband. There was no history of incontinence or tongue-biting.

On examination: There was no physical abnormality, and she was considered to be showing a mixed picture of anxiety and depression.

Special investigations: Skull X-Ray, normal. E.S.R. and Serum Bromide were normal. W.R., Negative. There was no blood dyscrasia. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: It soon became apparent that she was suffering, not from epilepsy, but from anxiety hysteria. This was aggravated by the conflict she was having about leaving her husband, at this time in her life. Arrangements were made for her to have group psychotherapy.

She was last seen in December, 1952, when no substantial change was reported.

Miss M.L.G. (22) 18.4.50.

Reason for referral: The investigation of left talipes equino-varus which began six months earlier.

Family history: The father suffered from cardiac neurosis and bilateral foot drop. The mother was menopausal and temperamental. One brother attempted suicide at the age of sixteen, and another brother died in a fit at the age of six months.

Personal history: Her childhood was uneventful. She did well at school, and then went on to do clerical work, which she had done fairly systematically until two months before admission to hospital.

Previous illness: At sixteen, she had gastric trouble which may have been anorexia nervosa. When she was twenty, she had had an attack of meningitis.

Previous personality: A moody girl who was subject to attacks of irritability.

History of present illness: Six months earlier, she had complained of pain under the left foot. This was treated by plaster of paris and slowly the foot turned in so that she developed a definite equino-varus deformity. She was unable to straighten it herself.

On examination: There was no physical abnormality, save the left talipes equino-varus. Mentally, she showed a marked indifference to her symptoms.

Special investigations: W.R. - Negative. X-rays of skull and left ankle were normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change, nor did the use of seconal.

Progress: Her condition remained no different throughout her stay in hospital, in spite of attempts at psychotherapy. She was discharged with a diagnosis of left talipes equino-varus of a hysterical nature.

Reason for referral: For the previous ten months, he had been troubled by excessive day-dreaming and jerking movements of his limbs.

Family history: There was no relevant information, apart from the fact that his mother and sister had thyrotoxicosis.

Personal history: His birth and early development were normal. He was educated at elementary and grammar schools in South Wales. Subsequently, he took up clerical work, and had been employed at the Air Ministry most of his working life. In 1944, he married, but his wife had had no children, since he had been afraid he might have a mental breakdown.

Previous illness: He had a nervous breakdown at the age of 20, in which he was depressed. He recovered after a few months without treatment. In 1947 he had a subtotal thyroidectomy.

Previous personality: Always, he had been a cheerful, affectionate person who was subject to mood swings.

History of present illness: During the previous ten months he had suffered from attacks of day-dreaming to a degree and with a frequency he had not experienced since his depressive illness in 1931. On occasions, he had talked out loud, and at other times jerking movements of the limbs had occurred.

On examination: There was no physical abnormality. Mental: He appeared to be anxious and mildly elated. Otherwise, there was no abnormality.

Special investigations: W.R. Negative. E.S.R. and Serum Bromide were within normal limits. Intelligence: Matrices I.Q., 103. B.M.R. = plus 12 per cent. EEG: The resting record showed a great deal of paroxysmal fast activity. These appearances were made more prominent following seconal administration and following photic stimulation. The injection of 400 mgm. of metrazol produced no specific change. Epilepsy was not considered to be present.

Progress: In time the patient improved gradually, and under narco-analysis he was allowed to work out some of his fantasies. He was discharged with a diagnosis of schizoid psychopathy and returned to work at the Air Ministry.

In October, 1951, he was seen again, when he was noted to be tense and anxious, and he behaved as if he were hallucinated. He refused admission to hospital, and was not seen again.

Mr. J.H. (37) 20.7.50.

Reason for referral: The investigation of a sleep disturbance and nocturnal enuresis which had begun five years earlier.

Family history: There was evidence of alcoholism and of insanity in the mother and in other more distant relatives.

Personal history: He was a shy, nervous child, but had no serious illness apart from a high fever during the encephalitis epidemic of 1919. He was educated at a number of preparatory and public schools. Although a good scholar, he was not a good mixer. After two years at Cambridge, he was sent down for excessive drinking. Subsequently, he worked as a publisher. He served with the International Brigade, and he had an administrative commission in the Royal Air Force from 1941-46. Recently, his working ability had been poor, and at the time of admission he was looking for a job as a night watchman. He had been twice married and twice divorced for cruelty. Recently, he had lived with an ex-nurse who had been discharged from the profession for taking an overdose of barbiturates. She was pregnant by him.

Previous illness: He had a gunshot wound of the left arm in 1937. This was followed by amputation. Twice he had been a voluntary patient in a mental hospital, in 1947 and earlier in 1949.

Previous personality: He had been always irritable and quarrelsome, showing irresponsibility and little foresight.

History of present illness: Since 1945, life had become more difficult. He experienced enuresis almost every night, and he had had difficulty in sleeping. He had become more aggressive and had shown marked hostility towards his friends.

On examination: There was no physical abnormality apart from the amputation stump of the left arm. He was suspicious and paranoid in his attitude, but there was no evidence of any deterioration.

Special investigations: W.R. - Negative. The C.S.F. was normal. Skull X-Ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: He was occasionally enuretic in hospital, but in view of the negative findings, no diagnosis of epilepsy was made. He was considered to be an inadequate psychopath.

Mr. G.E.H. (21) 31.3.49.

Reason for referral: The investigation of fits which he had had for seven years.

Family history: His father was a quick-tempered man, and two of his brothers suffered from fainting attacks.

Personal history: He was backward in his development, and was enuretic to the age of fourteen. At school he was considered to be a mental defective.

Previous personality: He was a rather gentle, solitary youth.

History of present illness: At the age of fourteen, he began to have fainting attacks. When he was sixteen, he was upset by an air-raid, and after that he suffered from attacks of rage, associated with shivering, sweating and a partial loss of consciousness. A year later, he went into Chalfont Epileptic Colony, where his attacks were thought to be epileptic in nature. In 1946, he was seen at St. Thomas's Hospital, where a diagnosis of epilepsy was made, and he was then referred to the Maudsley Hospital, where it was thought that his symptoms were borderline between those of hysteria and epilepsy. He continued to attend as an out-patient, and found work as a gardener at Hampton Court Palace. His attacks became more frequent, and appeared to be precipitated by loud noises. Recently, they had occurred daily, and had interfered with his work.

On examination: There was no physical abnormality, but he appeared to be a rather suggestible person.

Special investigations: W.R. - Negative. Intelligence: Matrices, I.Q. 82. The electrocardiagram showed an extreme degree of excitability. EEG. - The resting record showed an excessive amount of slow theta activity, but the use of photic stimulation, seconal and the injection of 400 mgm. metrazol produced no change.

Progress: Following admission, several attacks were seen. These were clearly not epileptiform in type. It was noted that sudden loud noises produced instability of his cardiac rhythm. His fits ceased after it was suggested to him that he was much better, and that his attacks would not recur. He was seen last in April, 1952. There had been no further attacks, he was holding down his job at Hampton Court, and was thinking of joining the Navy.

The final diagnosis was hysteria.

Mr. A.H.H. (35) 27.3.50.

Reason for referral: The investigation of attacks of "blank spells", which he had had since childhood.

Family history: One of his sisters had suffered from "blank spells" in childhood.

Personal history: Apart from the fact that he had fallen on his head as a child, there was no finding of note. He had an elementary school education, and worked subsequently as a musician. He had been making a rather erratic living as a dance-band drummer. During the war, he gained exemption from military service by reason of a certificate which he got from a Harley Street specialist, which stated that he had suffered from epilepsy all his life. He was married, but was unhappy in his relationship with his wife.

Previous personality: He had been always a rather shiftless person, who had not made a very adequate adjustment to life.

History of present illness: He complained that since the age of twelve he had attacks in which he felt in a daze, or in a dreamy atmosphere. As a result of these attacks, he had found it difficult to concentrate. There was no history of tongue-biting or incontinence at any time.

On examination: Physical: There was no abnormality of note. Mental: He gave the impression of being an unreliable person who purposely gave an incomplete account of his illness.

Special investigation: EEG. - The resting record was abnormal only by reason of the presence of some slow theta activity. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: In the light of his history, he was not considered to be suffering from epilepsy, and a diagnosis of psychopathic personality was made. No further action was taken.

Mrs. E.A.H. (62) 22.12.49.

Reason for referral: The investigation of fits which began at age 27.

Family history: There was no relevant information.

Personal history: Her early and adult life had been uneventful. She was married and had a son and daughter. The son was rejected from military service by reason of psychoneurosis. The son and daughter did not hit it off very well, and did not speak to one another.

History of present illness: She had had epileptiform attacks since the age of 27. In recent years, they had become less frequent, but she had had fairly regular attacks of weeping. In the epileptiform attacks, all her limbs jerked violently, and subsequently she fell into a deep sleep. She was never incontinent.

On examination: Physical: There was no abnormality. Mental: She was rather histrionic in her behaviour, but otherwise no abnormality was noted.

Special investigations: EEG. This, on two occasions, showed the presence of sharp and slow waves in the left frontal region, but no specific epileptic features were seen. Photic stimulation produced no change, and the patient refused to have seconal or metrazol.

Progress: Subsequently, the physician in charge of the patient made a diagnosis of hysteria, and considered that there was no further need for her to attend.

Mr. J.F.L. (40) 21.1.49.

Reason for referral: Attacks of headaches and occasional lapses of consciousness which he had had since 1945.

Family history: There was no information of note.

Personal history: He had had a healthy childhood. On leaving school, he went to work on the railway as a plate-layer. In 1944, he went into the Army. Subsequently, he went to work as a capstan operator, but found it difficult to continue in this employment.

History of present illness: In March, 1945, he landed with an air-borne division in Germany. Most of his company were killed, and he saw numerous unpleasant sights. He developed his attacks then, which consisted of headaches, sickness, diarrhoea and tremor. These were associated with attacks of loss of consciousness. There was no history of tongue-biting or of incontinence, and on no occasion did he injure himself. He was evacuated to England, and his symptoms cleared up. Later, he was posted to Egypt, and his symptoms returned. He was demobilised in the normal manner. In 1948, he was admitted to Belmont Hospital, Sutton, where a diagnosis of chronic anxiety state was made, and he was helped by a course of modified insulin therapy. After that, he became a war-pensioner, and attended the follow-up clinic at the Maudsley Hospital. His attacks continued at regular intervals.

On examination: He had no physical abnormality. On mental examination, he was extremely tense, and appeared to have been sleeping badly. His intelligence did not appear to be very high, but there was no evidence of deterioration.

Special investigation: EEG. - The resting record was normal. The use of photic stimulation and the injection of 400 mgm. of metrazol evoked no abnormality.

Progress: A diagnosis of a chronic anxiety state secondary to the stresses of war was made. He ceased to attend hospital after the possible diagnosis of epilepsy had been excluded.

Mr. H.M.M. (14) 8.2.49.

Reason for referral: The investigation of a history of "blackouts" which began six months earlier.

Previous history: The family history was not relevant, and his early life was uneventful. He had been considered to be a good scholar. His personality was that of a sensitive, solitary boy who gave little trouble to anyone.

History of present illness: Six months earlier, he had attended a Boys' Camp. Almost immediately, he had developed a dazed condition in which he spoke to no-one, but afterwards he said that he had had terrible dreams, and felt he was going to die. After ten days he came out of this state spontaneously, but he remained clumsy, inarticulate and had marked difficulty in concentration. His school work deteriorated, and he had two to three black-outs daily in which there was an immobile rigidity of the whole body for a few seconds, with no apparent loss of consciousness.

On examination: He was physically immature. Mentally, he was excited, incoherent and unable to describe his symptoms adequately.

Special investigations: Intelligence: Binet I.Q. 111. EEG. - The resting record was within normal limits. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: At first, no definite diagnosis was made, and he was given superficial psychotherapy, but after twenty months he developed hallucinations and delusions and went into a catatonic state. Then, as a frank schizophrenic, he had E.C.T. and insulin coma therapy which produced some improvement but he had an impaired personality, and was lacking in initiative. His "black-outs" were considered to be elaborate tics.

Mr. E.D.McN. (17) 21.2.50.

Reason for referral: Admitted for investigation following a self-inflicted injury two weeks earlier.

Family history: The mother and an elder sister were highly-strung. The mother had died eighteen months earlier.

Personal history: He was backward in his early development, and was enuretic to the age of seven. He left school at the age of fourteen, when in Standard VI. Since then, he had worked fairly well in the printing trade.

Previous illness: He had asthma for two years from the age of seven.

Previous personality: A shy, self-conscious boy, who was over-attached to his mother and dreamed frequently of her death.

History of present illness: Eight weeks earlier, he had begun to have attacks of anxiety accompanied by a fear of dying. These had occurred regularly three times per week. He attended a general hospital out-patient department with his complaint, but little attention was paid to him. Therefore, he inflicted upon himself a superficial knife wound to show them that he was really ill. He was then admitted to an observation ward, where he had attacks of depersonalisation. Two weeks later, he was admitted to the Maudsley Hospital from the Observation Ward.

On examination: There was no physical abnormality, and he appeared to show a combination of depression and anxiety.

Special investigations: Intelligence, Matrices, I.Q. - 111. EEG. - The resting record showed a fair amount of slow activity which was more marked in the left than in the right hemisphere. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: He was considered to be suffering from anxiety neurosis with depersonalisation. Treatment consisted of superficial psychotherapy, which helped him considerably. The patient was heard of last in October, 1951, when he had been charged at a magistrate's court with larceny.

Miss V.N. (16) 22.11.49.

Reason for referral: She was suffering from obsessional rumination and fear associated with an affective disturbance.

Family history: The father appeared to be an aggressive person, and the mother was a very highly-strung individual. A sister, aged twenty, suffered from neurasthenia.

Personal history: She was born following a very difficult labour. Numerous obsessive traits were noted in her as a child, when she would be found frequently washing herself, rubbing her fingers and touching her hair. Her schools were changed frequently, but eventually she won a scholarship, which she did not accept on medical advice. Her doctor thought that grammar school life would make her too anxious. She had worked for one year as a photographer's assistant.

Previous illness: Generalised vaccinia, following vaccination, as a child. Otherwise, there had been no serious illness.

Previous personality: She was an unusual child, who was markedly obsessive in her habits.

History of present illness: Since she had been four years old, she had had fears of death and dying. At puberty, this became the core of her rumination. She anticipated the end of the world in July, 1947, and this precipitated an attack of acute anxiety. Later, she concluded that she might be annihilated in bed by an asteroid body from outer space. This made her afraid to fall asleep, in case she died without warning.

On examination: Physical: Asthenic physique, a nervous tachycardia and mild hypertension were present. Mental: She was of good average intelligence, but her affect showed some inhibition. She ruminated continuously on the subjects of death and the life hereafter.

Special investigations: W.R. - Negative. EEG. - At rest, this showed an excessive amount of slower rhythms, and it was considered to be epileptoid in nature. However, photic stimulation and the injection of 400 mgm. of metrazol produced no specific change. She refused to have seconal.

Progress: This patient was given superficial psychotherapy over a fairly lengthy period. In March, 1951, she absconded during a period of acute recrudescence of her fears about death. However, she returned in May, 1951. Further investigation showed that her fears of asteroid bodies had been replaced by ruminations about death and sexual assaults. She became rather negativistic, and in June, 1951, she made a demonstrative suicidal attempt by taking eighteen tablets of aspirin in front of the other patients. A final diagnosis of a phobic state in an immature girl of obsessive personality was made, and she was discharged home on 9th June, 1951.

Soon afterwards, she entered a mental hospital near Canterbury, where she was given insulin treatment. She did not like this, and discharged herself from hospital. In the summer of 1952, she was noted to have settled down in London, where she had found work for herself.

Mr. F.N. (13) 4.5.50.

Reason for referral: Investigation following a homicidal attack on another child in June, 1949.

Family history: His mother deserted his father when the patient was three years old. A paternal uncle was said to be suffering from schizophrenia.

Personal history: His birth was normal, but after his mother's desertion he behaved as if he were "dead" for some time. The maternal grandmother, an over-possessive woman, brought him up after that. On one occasion in his early life, his private doctor found strangulation marks on his neck, but whether these were self-inflicted or not was never discovered. At school he did well, and won a scholarship to a grammar school.

History of present complaint: In June, 1949, he was throwing stones about aimlessly, and he accidentally struck a boy aged four. When he found that he had injured the little boy, he picked up a bigger stone, threw it at his head and killed him. In November, 1949, he was found guilty of manslaughter, and was sentenced to be detained for five years. He had been seen by several psychiatrists at that time, who considered that he was detached and isolated in his manner. It was thought by them that he showed evidence of incipient schizophrenia. Subsequently, he went to an approved school, but his examination at the Maudsley Hospital was thought advisable.

On examination: There was no physical abnormality, and no evidence was noted of the rather schizoid behaviour described earlier. He seemed to have the emotional behaviour of a normal boy of his age.

Special investigations: Intelligence: I.Q. Wechsler Full Scale 106. EEG. No epileptic activity was seen at rest, nor did any appear following the use of photic stimulation and the injection of 400 mgm. metrazol.

Progress: He was not seen again, but a school report in June, 1950, indicated that there had been a marked improvement in his behaviour.

Final diagnosis: Schizoid personality.

Mrs. O.J.P. (25) 30.5.50.

Reason for referral: The investigation of attacks of anxiety and migraine of many years' standing.

Family history: Her father suffered from attacks of migraine and convulsions which were thought to be hysterical. Eventually they were recognised to be Jacksonian in type, and a cerebral tumour was diagnosed. He died from this condition at age 48. The mother is 53, and suffers from neuro-retinitis and migraine.

Personal history: Her birth and early development were normal, but she was a highly-strung, nervous child, who was excessively accident-prone. She was a patient in Child Guidance Clinic here while at school, where she had a poor record. After leaving school, she had a remarkable variety of jobs, all of which she had to give up because of nervous ill-health. She married at the age of 24, but the relationship is not a happy one.

Previous illness: At the age of 19 she had a nervous breakdown, and was an in-patient at Sutton Emergency Hospital, where she had modified insulin therapy.

Previous personality: She has always been a nervous, hypo-chondriacal person.

History of present illness: For many years now she has had attacks of migraine, and has experienced attacks in which her limbs shook. She has always felt lifeless, and has been having nightmares which have become worse recently.

On examination: Physical. C.V.S.) C.N.S.) N.A.D. R.S.)

Mental: She is mildly depressed, and tends to ruminate on the subject of words which repeat themselves in her head.

Special investigation: W.R. negative. E.S.R.) Within normal Blood Bromide)) limits.

Intelligence: I.Q. Matrices 116. EEG. Resting record is normal. The use of photic stimulation and the injection of 400 mgm. of metrazol produce no change, nor did the use of seconal.

Progress: She failed to co-operate in attempts to treat her by psychotherapy, and so made little progress while in hospital. Eventually she was discharged with the diagnosis of anxiety state.

Mr. W.A.P. (51) 1.5.50.

Reason for referral: He complained of fits which he had had for twenty-six years.

Family history: His mother suffered from severe headaches, and died from sleeping sickness.

Personal history: In early childhood he practised head-banging and suffered from screaming fits. At school, he was of above average ability, and subsequently he had a good work record as a van salesman. He was married to a woman ten years his senior, and they had two children, of whom one had committed suicide at the age of thirteen by strangulation. (This was in 1935). The other child developed a stammer after his brother's death.

History of present illness: During the 1914-18 war, he had been blown up and concussed, but nothing abnormal was noted, and he was demobilised as A.1. In 1922, he had his first fit. Then he was treated at the National Hospital, Queen Square, where he was considered to be an epileptic, although he never bit his tongue nor was he ever incontinent. He remained relatively free from attacks until 1944 when he began to have frequent fits. Then he was treated at King's College Hospital, and the diagnosis of idiopathic epilepsy was confirmed. In 1949, he was sent to Lingfield Epileptic Colony, where no fits were observed during a period of ten weeks. Subsequently, he was referred to the Epileptic Clinic at Maudsley Hospital. Essentially, in the attack, when it had been witnessed, he slid slowly to the floor, went stiff and clenched his hands tightly. The attack lasted for about half-an-hour, then he fell asleep and on waking was very irritable.

On examination: There was no physical abnormality, but he was considered to be a rather paranoid person.

Special investigations: W.R. - Negative. Skull X-Ray - Normal.
Intelligence: Matrices, I.Q. 100. EEG. - The resting record was normal. Photic stimulation, seconal and metrazol produced no change.
Progress: It was considered that his attacks were hysterical in nature, and he was sent for treatment to Belmont Neurosis Centre. There it was found that he improved when anti-convulsant medication was withdrawn. On discharge, he was found a job as a Government messenger, but in May, 1942, he was sacked because he had been having blackouts while carrying important documents. When seen last, he had found a job as a postman, and was free from attacks.

Reason for referral: The investigation of "fits" which he had been having for a few months.

Family history: There was no relevant information.

Personal history: His early childhood was uneventful. At school he was an average scholar. Subsequently, he did simple manual factory work.

Previous illness: At the age of fourteen, he had a febrile illness which in time was followed by a tremor of the left arm and leg, rigidity of these limbs, general slowness and a tendency to excessive sleep. This condition of parkinsonism had continued unchanged since adolescence.

Previous personality: He was a friendly, conscientious person.

History of present illness: Several months earlier he had begun to have attacks in which he stared straight ahead of him, became immobile and unresponsive. These attacks appeared to be precipitated by emotional excitement. After such behaviour, he sometimes became acutely excited, and had ideas about murdering everyone. He was admitted to an observation ward whence he came to the Maudsley Hospital.

On examination: He was found to have a mask-like facies associated with rigidity and tremor of the left arm and leg. He showed some evidence of depression, and of a tendency to ruminate about his inadequacies. He was considered to be mentally defective.

Special investigations: W.R. - Negative. Intelligence; Wechsler full-scale I.Q. 64. E.E.G. - The resting record was normal. The use of photic stimulation, seconal and the injection of 400 mgm. metrazol produced no change.

Progress: He settled down well in the hospital, but he continued to have attacks of the type described above. These proved resistant to treatment with amphetamine sulphate, benadryl and parpanit. It was considered that the attacks described were akinetic fits. Arrangements were made to follow him as an out-patient, but in November, 1949, he had to be re-admitted to the Observation Ward, in a further attack of excitement. Following this, he was treated with tincture of belladonna and tincture of stramonium to help his tremor.

Mr. G.M. (24) 26.1.50.

Reason for referral: The investigation of a fainting attack which he had had a fortnight earlier.

There was no relevant family or personal history.

Previous illness: He had had several attacks of dizziness which were associated with vomiting.

Description of the attack: On the night of his illness, he had had an attack of dizziness, associated with a headache and vomiting. Then, after falling asleep, he awoke around 3 a.m. with an abdominal pain, and went to the toilet, where he fainted and was found by his wife. He then vomited and started to scream. His wife got him to bed where he continued to talk in a rambling fashion. He had almost a total amnesia for these events.

On examination, there was no abnormality noted.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The record showed a dominant alpha rhythm but photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: When seen again in March, 1950, he had had no further attacks. A diagnosis of hysteria was made.

Mr. W.J.S. (14) 20.4.50.

Reason for referral: The investigation of temper tantrums which were alleged to be related to epilepsy.

Family history: Two of the patient's brothers suffered from enuresis.

Personal history: In early childhood he suffered from enuresis, and had frequent temper tantrums. He was evacuated at the age of five, and since then he had been at home only for one year.

Previous personality: He had been a rather babyish boy, who was unhappy unless he was the centre of interest.

History of present illness: From the age of five, his temper tantrums necessitated frequent changes of foster home and of residential schools. In December, 1948, he was convicted of larceny, and was sent to a Church Army remand centre. There he had frequent outbursts of rage which led to his being referred to Stamford House, the central remand home for the London area. A psychiatrist who saw him there thought his attacks were epileptic, and referred him to the Maudsley Hospital .

On examination: He had numerous jerking movements which were choreiform in type - otherwise, there was no abnormality.

Special investigations: W.R. - Negative. Skull X-ray - Normal. EEG. - The resting record showed traces only of alpha activity, and was dominated by theta rhythms. However, photic stimulation and the intravenous injection of 400 mgm. metrazol produced no change.

Progress: No abnormal behaviour was noted while he was an in-patient, and arrangements were made for him to live at his own home so that he could grow up under parental influence. A final diagnosis was made of a behaviour disorder secondary to Sydenham's chorea. He continued to attend for supportive psychotherapy.

Mr. W.S. (49) 1.2.50.

Reason for referral: The investigation of three attacks of loss of consciousness in the previous two years.

No information was available about his family or personal history.

Description of attack: He had had three transient attacks of loss of consciousness in the previous two years. Each attack was preceded by a curious paroxysmal cough. He had never been incontinent, nor had he bitten his tongue, but he had injured his nose when he fell during his last attack.

On examination, he was found to be emphysematous, obese and plethoric.

Special investigations: W.R. - Negative. X-ray of skull was normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: It was considered that the patient was not suffering from epilepsy.

Mr. F. S. Aged: 36 July, 1949.

Reason for Referral:

The investigation of headaches, associated with fainting attacks, which he had had for ten years.

Family History:

This was essentially negative.

His personal history was uneventful.

History of Present Illness:

Since 1939 he had suffered from attacks of headaches at regular intervals. Each attack was preceeded by bright lights which he saw in front of him and as the attack developed he experienced severe headache in the right temporo-occipital region. This was followed by nausea and vomiting. Occasionally he felt faint and fell unconsciousnto the ground, but there was no evidence of tongue biting or incontinence.

On examination:

There was no physical or mental abnormality.

Special Investigations:

Skull x-ray was within normal limits.
E. E. G. resting record was normal and the use of photic stimulation, seconal and intravenous metrazol produced no change.

Progress:

In view of the history and of the negative findings it was considered that he was suffering from classical attacks of migraine for which he was treated, successfully, with phenobarbital.

Reason for referral: He was referred from an Observation Ward for the investigation of outbursts or aggressive behaviour following a head injury three months earlier.

Family history: There was no information of mental or nervous disorder in the family.

Personal history: He had a difficult childhood in that he grew up in an orphanage. He went to sea for a number of years, then served in the Royal Air Force until 1942, when he was invalided out on psychiatric grounds. His subsequent career was obscure. It was probable that he had been in prison, but recently he had worked as a bath attendant. He married in June, 1948, and his wife had had twins. His habits were fairly temperate, but he could become drunk on three glasses of cider.

Previous illness: He had a series of head and spine injuries, while in the R.A.F. between 1940 and 1942. All were due to falling down or being knocked down, and one was attributed definitely to drunkenness. At no time did he sustain any serious injury. In 1946, 1947 and 1949 he had treatment as a voluntary patient in mental hospitals where he had E.C.T. and continuous narcosis.

Previous personality: He was said to have been moody and negativistic. His account of his life differed markedly from the accounts in official records, and he was considered to be a pathological liar.

History of present illness: In June, 1949, he was accidentally struck on the head by a wooden pole, while working as a baths attendant. After that, he felt confused and had himself admitted to an Observation Ward because he felt afraid he might kill his wife and family. After ten days, he was discharged home. He continued to sleep badly, and complained of headaches. In August, 1949, he had himself admitted to another Observation Ward where he was considered to be in a post-epileptic confusional state. Then he was referred to the Maudsley Hospital, where he was admitted for investigation.

On examination: No physical abnormality was seen. Mentally, he appeared to be rather confused, a condition which was thought to be due to the effects of alcohol recently consumed, since it cleared soon after admission.

Special investigations: W.R. Negative. E.S.R. 2 mm. Serum Bromide less than 25 mgm. per cent. Skull X-Ray Normal. EEG. - The resting record was normal, and the use of photic stimulation, followed by the injection of 400 mgm. metrazol, produced no change. An EEG. during seconal sleep showed no abnormality.

Progress: A diagnosis of a hysterical reaction in an inadequate psychopath was made. He was discharged, and was last heard of in March, 1950, when he was again a patient in an Observation Ward.

Mr. W.T.S. (29) 12.5.49.

Reason for referral: The investigation of attacks of unconsciousness which he had had for the previous two and a half years.

Family history: There was no relevant information.

Personal history: His early life was uneventful. He only reached Standard 5 at the age of fourteen, before leaving school. Subsequently, he worked as a van boy until he joined the army in 1939. He was a prisoner-of-war from 1940-45, and worked subsequently as a docker. On return to England in 1945, he married, but failed to consummate the marriage by reason of his impotence.

Previous personality: He was a cheerful, active person, and a good mixer.

History of present illness: About two and a half years earlier, he had begun to have attacks of unconsciousness which lasted for from a few seconds to five minutes. They occurred generally towards evening, or when in bed, before sleep. Each attack was preceded by a headache. In the attack, he perspired, and his speech was blurred for some minutes afterwards. Once, in an attack, he had passed water involuntarily; his wife described seeing him jerking his arms and legs, and sometimes he raved about being attacked, by Germans. Recently, the attacks had become more frequent, and he was having as many as thirty to forty per day.

On examination: There was no physical abnormality of note. He was a little anxious, but there was no evidence of mental deterioration.

Special investigations: W.R. - Negative. Skull X-ray - Normal. C.S.F. - Normal. Intelligence: Matrices, I.Q., 94. EEG. - The resting record was normal. Photic stimulation, seconal and the administration of 400 mgm. metrazol produced no change.

Progress: Following admission, he had a few blackouts. In these he sank slowly to the floor, but did not lose consciousness. In discussion, it was apparent that his sexual impotence was his greatest worry, and that his "blackouts" might be due to anxiety about this. A final diagnosis of hysteria was made.

Master K.S. (5) 4.5.49.

Reason for referral: The investigation of temper tantrums, enuresis and blackouts.

Family history: The paternal grandfather suffered from schizophrenia. Two maternal aunts suffered from thyroid dysfunction.

Personal history: He was backward in his development, and at the age of two was considered to be a mental defective suffering from hypothyroidism. He was treated with thyroid.

Previous personality: He was always an aggressive, violent and spiteful child.

History of present illness: His aggressive behaviour at home soon became a fairly major problem. At the age of three, he began to have blackouts, in which he stared suddenly and became quite unresponsive. He was treated with phenobarbitone which had no effect on his blackouts. Instead, his aggressive outbursts and his enuresis became much more noticeable.

On examination: He was a sullen little boy, who spoke badly, but had no physical abnormality.

Special investigations: Blood cholesterol 213 mgm. per cent. Intelligence: I.Q. Merrill Palmer, 94. EEG. - The resting record was probably within normal limits. Photic stimulation and the use of seconal produced no specific change.

Progress: Following admission, he settled down very well in spite of some initial defiant behaviour. No blackouts were observed. In time, he presented as a rather timid, unsociable and often contrary boy. It was considered that his abnormal behaviour was induced by a difficult home situation, in which his parents were over-anxious about him. These matters were discussed with his parents, and in time his behaviour at home improved also. A final diagnosis of behaviour disorder was made.

Mrs. J.L.S. (61) 1.2.50.

Reason for referral: The investigation of frequent petty crimes which she had committed over a period of fourteen years.

Family history: Her mother deserted the home when the patient was twelve years old.

Personal history: Her early life was difficult because of poor economic circumstances, and after her mother's departure she had to bring up the four younger children. She married at the age of thirty, and subsequently had six children. Her husband was an alcoholic who ill-treated her continually.

Previous health: At the age of forty she acquired syphilis and gonorrhoea from her husband, and developed nephritis during arsenical therapy. Later, she had an attack of gonococcal arthritis. At forty-five, she had a hysterectomy for fibroids.

Previous personality: She had always been a person of unstable temperament, and tended to blame others for her difficulties.

History of present illness: Since childhood, she had suffered from fainting attacks, in some of which she had fallen and injured her head. At the age of forty-six, she began to shop-lift in a state of temporary amnesia. She was detected then and find £3. Subsequently, further offences of a similar nature, for which she was either fined or put on probation, occurred in 1936, 1938 and in 1946. A further offence had taken place two weeks before referral to hospital. She stated that she went into Marks and Spencer's, and while there she had a peculiar feeling in her head and felt that regardless of people seeing her she was compelled to take goods from the counters. She took three pairs of socks and a tie. Then she went on to Woolworth's where she acquired some bulbs without having any good reason for doing so.

On examination: There was no physical abnormality. She was extremely tense, but there was no evidence of intellectual impairment.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record was normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: It was considered that her behaviour was attributa to an anxiety state, secondary to domestic stress. She was put on probation in order that she might have superficial psychotherapy, and little further of note occurred.

Reason for referral: A history of dizziness, sickness and feelings of uneasiness when at work. The complaint was of two months' duration.

Family history: The father was a bad-tempered person, and the mother was a highly-strung woman; otherwise there was no relevant information.

Personal history: His birth and early development were normal, and he had no neurotic complaints as a child. However, he had attacks of headaches and biliousness in childhood. He was backward in school to begin with, but in time he managed to do the work and was in the top standard when he left school at the age of fourteen. He had worked as a motor mechanic, and his work record was good. During the war he served as a sergeant in the Royal Engineers, and saw service in India and Burma.

Previous illness: He had malaria several times between 1943 and 1945. Occasionally, he had had bilious attacks with headaches and eye symptoms.

Previous personality: He was a good, conscientious worker, who was liable to have attacks of anxiety.

History of present illness: Recently, the patient had begun night shift work, and he had been upset by the blue colour of the artificial lighting. One month earlier another worker fainted, and the patient, who witnessed this attack, nearly fainted also. Since then, he had been afraid to go into this workshop. His heart and pulse beat violently, and he felt very sick whenever he approached it. He had had several panic attacks in which he felt that he must get out of the place. In these attacks he shook like a leaf, was unable to carry on working and was sent home.

On examination: There was no physical abnormality. Mental: He showed evidence of anxiety and demonstrated some obsessive mechanisms. There was no evidence of any intellectual impairment.

Special investigations: X-Ray, Chest: Normal. EEG. - The resting record showed a mixture of fast and slow rhythms. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: A diagnosis of anxiety hysteria was made. Subsequently, the patient was given group psychotherapy, from which he derived some benefit.

Mr. W.T.J.T. (20) 6.2.50.

Reason for referral: The investigation of blackouts which he had had since 1947.

Family history: His father attempted suicide three times before his death from cancer.

Personal history: His early life was uneventful, apart from an attack of rheumatic fever at the age of fourteen, from which he recovered without incident. He had a good school record. Later, he worked as a plumber. In 1947, he joined the Royal Marines, from which he was discharged in 1949 on psychiatric grounds. Then he returned to his former occupation, but had difficulty in finding suitable employment.

History of present illness: He regretted having joined the Royal Marines very soon after his service began. While in Malta in 1947, he had dizzy spells during rock-climbing training, and once fell 200 feet without sustaining serious injury. His mother developed cancer in 1948, and when he applied for compassionate leave to visit her this was refused, and he was posted to Hong-Kong. There he became irritable and moody, and complained of pains in his limbs. Finally, he was flown home and found his mother in a state of coma in which she died without having recognised him. After that, he became rather depressed, and was later discharged from the service. He continued to have blackouts in which he fell to the ground, but he never injured himself. He did not bite his tongue, nor was he ever incontinent.

On examination: There was no physical abnormality. Mentally, he appeared to be rather anxious, and was very bitter against the Service authorities.

Special investigation: EEG. - The resting record showed a fast and slow dysrhythmia, but was otherwise normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: A diagnosis of anxiety hysteria was made. Arrangements were carried out with the Ministry of Labour to have him registered as a disabled person, in order to facilitate his re-employment as a plumber. Nothing further was heard of him.

Reason for referral: The investigation of fits which he had had for one year.

Family history: The maternal grandmother suffered from senile dementia.

Personal history: He was a backward, nervous child. Temper tantrums occurred frequently in childhood, and he was afraid of the dark. At school, he was an average scholar, but he preferred to play with the girls at their games, and had little in common with the boys. He had done various jobs - office-boy, shop assistant and lately he had been a stoker.

Previous illness: He made a suicidal attempt by swallowing aspirins, when depressed, a year earlier.

Previous personality: He had been an effeminate youth, subject to attacks of depression. At times he had allowed himself to be picked up by active homosexuals, and had gone to live with them in their flats.

History of present illness: He had begun to have fits about a year earlier. The warning consisted of a pain which crossed his eyes from left to right. In the attack he fell down unconscious, perspired profusely, had bitten his lip but had never been incontinent. A clonic phase always followed the tonic phase. These fits occurred usually once per month, and had been noted at all times, even in the night. A few weeks prior to admission he had gone to live with a homosexual, and after a few days there, he set fire to the flat in impulsive fashion, and escaped. However, he was caught soon after by the police, and was sent to a remand home, where the attacks were noted to occur more frequently. From the remand home he was admitted to the Maudsley Hospital.

On examination: There was no physical abnormality, but he appeared to be abnormally anxious and tense.

Special investigations: W.R. - Negative. X-Ray of Skull - Normal. Intelligence: Matrices I.Q. 116. EEG. - The resting record was within normal limits. Photic stimulation, seconal and the injection of 400 mgm. metrazol produced no specific change.

Progress: In hospital, no further attacks were noted. It was considered that he was not an epileptic, and he was discharged for out-patient supervision on 24th September, 1949. A month later he became depressed, and made a serious suicidal attempt by gassing, and he was re-admitted. Attempts were made to treat him by superficial psychotherapy, but by 8th December, 1949, he had become so deeply depressed that it was found necessary to transfer him to the Observation Ward, to prevent a further suicidal attempt.

A final diagnosis of recurrent depression was made.

Miss V.R.W. (35) 29.3.49.

Reason for referral: The investigation of headaches and attacks of "blankness" which she had had for ten years.

Family history: One brother suffered from migraine.

Personal history: Her early development had been normal, but after leaving school she had had numerous changes of occupation. She had become resentful, unpleasant, and had given up her jobs with little provocation. She worked during the war as an air raid warden, but more recently she had been doing domestic work.

Previous illness: In 1940, she had had an acute exacerbation of her present complaint, and had been admitted to the Maudsley Hospital where a diagnosis of petit mal had been made. She was put on phenobarbitone on which she improved.

Previous personality: She had been always a difficult and aggressive person, with few friends and only limited outside interests.

History of present illness: Since her discharge from hospital in 1940, she had continued to have frequent changes of employment through her inability to get on with people. Her headaches and her feelings of blankness had occurred at regular intervals, but during the previous year her headaches had occurred daily, and she had been complaining of "fits" which took place two to three times per day.

On examination: There was no physical abnormality. She appeared to be a woman of low intelligence, who was somewhat depressed.

Special investigations: W.R. negative. Skull x-ray - Normal. EEG. - The resting record was normal. The use of seconal and photic stimulation, and the injection of 400 mgm. of metrazol, produced no change.

Progress: Following admission, she had only one attack which appeared to be hysterical in nature, and showed none of the features of epilepsy. She was sullen and morose, and found it difficult to co-operate with the staff and patients. She discharged herself from hospital a few weeks after admission, and nothing further was heard of her.

Miss B. E. W. (13) 28.10.49.

Reason for referral: She was referred by a gynaecologist for assessment of the psychogenic element in her attacks of spasmodic dysmenorrhoea.

Family history: No relevant information was available.

Personal history: Her birth was a difficult one, but her subsequent development was normal. She won a scholarship to a grammar school, where she had behaved like a tomboy. She resented the onset of her menses at the age of ten.

Previous personality: Always she had been a very active girl, fond of boys' games.

History of present illness: Since the onset of the menses, she had had dysmenorrhoea, which occurred twice during each menstrual flow. She experienced a great deal of anxiety in relation to each period. In spite of various drug treatments, no relief had been obtained. Examination under an anaesthetic revealed no abnormality of the pelvic organs, and the cervix was dilated. Blackouts had occurred occasionally during attacks of dysmenorrhoea.

On examination: There was no physical abnormality. Mental: She was a sociable girl without any obvious neurotic features.

Special investigations: EEG. - The resting record showed an excessive amount of slow theta activity, but repeated tests with photic stimulation, seconal and the injection of 400 mgm. of metrazol revealed no change.

Progress: During her stay in hospital, she was given a course of psychotherapy, in which she displayed marked hostility towards her mother. Her menstrual pain varied in intensity, but it persisted. Eventually she was discharged with a diagnosis of a psychogenic reaction affecting sexual function.

In April, 1950, a gynaecologist operated on her, found follicular cysts in both ovaries, which he punctured. He removed the appendix, and did a presacral neurectomy. This improved her condition considerably, but in February, 1951, her pains had returned.

Mrs. E.L.W. (38) 2.3.50.

Reason for referral: Investigation of attacks of pins and needles in both hands associated with jerking movements of both arms. These attacks had been occurring at fortnightly intervals for two years.

There was no relevant family history known.

Personal history: When the patient was two years old, her father attempted to murder her mother with a razor. Subsequently, the patient was brought up in an orphanage. She married at the age of sixteen, but her husband died after nine years of marriage. Then she "married" Mr. W., who turned out to be a bigamist. Since then, Mr. W. had been frequently in prison for bigamy and petty larceny. In spite of all this, the patient remained devoted to him. She had two children by the first marriage, of whom one had already had an illegitimate child. By the bigamous marriage, she had three children.

Previous illness: She had had fainting attacks for the previous twelve years.

Previous personality: She had been always a rather shiftless person.

History of present illness: During the previous two years, she had had regular attacks of pins and needles in both hands, associated with twitching movements of the arms. With these attacks, she felt faint, but she did not always lose consciousness. She never bit her tongue, nor was she ever incontinent. The attack lasted for ten minutes, and she had a headache afterwards.

On examination, no abnormality was noted.

Special investigations: W.R. - Negative. Skull X-Ray - Normal. EEG. - The resting record showed some fast beta activity, but was otherwise normal. Photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: Clinically, the attacks were considered to be hysterical in nature, but she was treated with phenobarbitone and the attacks became less frequent. In November, 1950, she had fits of screaming with the attacks. Then she was seen by Dr. McDonald Critchley after an attack, and was found to have a hemi-anaesthesia. He considered her to be suffering from epilepsy with a hysterical overlay, and prescribed epanutin as well as phenobarbitone. In December, 1950, she had uncontrollable attacks of weeping on hearing that Mr. W. had been sent to prison again. Then she was sent to the Observation Ward for two weeks. When last seen in August, 1951, she was having three attacks each month, in spite of treatment.

Mr. A.V.W. (30) 25.5.50.

Reason for referral: He was referred because he had experienced a strong desire to set fire to his house.

Personal history: He was backward as a child, and had neurotic tendencies including a stammer which he had had since the age of ten. Fainting attacks had also occurred at frequent intervals since early childhood, in which he fell and bit his tongue, but was never incontinent. His school record had been a poor one, and he had been employed chiefly in labouring jobs.

Previous illness: In 1943, he served a prison sentence for arson.

History of present illness: During the past year, things had been rather difficult at home because of his liaison with another woman. He had been anxious to leave his wife, but she had refused to agree to a separation. Recently, he had been experiencing an almost uncontrollable desire to burn his house down, and having discussed the matter with his probation officer, he was referred to the Maudsley Hospital.

On examination: There was no outstanding abnormality, apart from his stammer and his low intelligence.

Special investigations: W.R. - Negative. EEG. - The resting record was normal; photic stimulation and the injection of 400 mgm. metrazol produced no change.

Progress: A diagnosis was made of an anxiety reaction in a man of low intelligence, and arrangements were made for him to be admitted to a mental hospital as a voluntary patient. Later, he was reunited with his wife, and his impulse to set fire to his house disappeared.

SUMMARY OF INVESTIGATION.

Total number of patients examined.....126
(This excludes the small group with abnormal records described in the first part of the investigation.)

Total number of epileptics exposed to photic stimulation..... 48

Positive result from photic stimulation alone.....2(4.2%)

Total number of epileptics who were given metrazol.....42

Positive result from metrazol alone.....23(56.1%)

Total number of non-epileptic patients who were given metrazol.....69

Falsely positive result from metrazol alone.....16

" " " " " plus photic stimulation.....5

Total.....21(30.4%)

Total number of non-epileptics exposed to photic stimulation alone without positive result.....73

Total number of epileptic patients who had "Seconal"....24

Positive result from "Seconal" alone.....2(8.3%)

Total number of non-epileptics who had "Seconal" without positive results.....36.

Insulin hypoglycaemia was of value in one patient, and scopo-chloralose was used on two patients unsuccessfully.

ANALYSIS OF TEST RESULTS

In all 131 patients were examined, of whom 5 had shown undoubted proof of epilepsy beforehand. This small group was included to demonstrate the efficacy of the tests, and photic stimulation was the chief provocative agent used. Therefore, 126 patients were examined for the purpose of deciding whether they were epileptic or not. For various reasons, it was unfortunately not possible to use all the methods described on each patient, but the great majority was examined with the use of photic stimulation and metrazol.

Initially, it was thought that all the patients might be suffering from epilepsy, but as a result of following up their records over a period of three to four years, it has been possible to make more accurate diagnoses. Therefore, this thesis presents a much more valid concept of the value of the tests than does the paper by the present writer (Hutchinson, 1951), which was based on a shorter survey of a slightly smaller group of patients.

Method used	Number of patients examined	EEG. findings	
		Epileptic wave forms	No change
Photic stimulation	121	2 (1.6%)	119
Metrazol	111	44 (39.6%)	67
"Seconal"	60	2 (3.3%)	58

The /

The results of the use of photic stimulation are disappointing in that they are less striking than in the literature reviewed earlier. However, it is important to remember that Walter and Walter (1949) indicated that it was impossible to provoke epileptiform abnormalities by photic stimulation in patients whose resting records were normal, although such abnormalities could be produced in patients without any previous history of epilepsy.

The use of "Seconal" has also proved disappointing, since it was of diagnostic value in only 2 (8·3%) out of 24 epileptic patients. This finding compares well, however, with that of Cohn, Nardini and Boswell (1952), who noted that sleep (induced by barbiturates, etc.) produced spike and wave activity in only one patient among 26 examined. This method might have yielded more information had it been used more extensively during examination on a six-channel apparatus. However, the majority of the patients was examined with the aid of a two-channel machine, the scope of which was rather limited. It has been pointed out by Merlis et al. (1951) that this method is of greatest value in the diagnosis of temporal lobe epilepsy, which was beyond the scope of this investigation. It is also possible that had a quick, short-acting barbiturate been given intravenously, sleep would have been achieved more easily in many of the patients who were remarkably resistant to oral "Seconal".

Metrazol has been demonstrated to be a much more potent activating agent than either of the other two methods. The

gross /

gross results have been described above. These findings have been analysed further. As a result of follow-up investigations, it was shown that of the 111 patients examined with the aid of metrazol only, 42 were suffering from epilepsy. The test was found to be of diagnostic value in 23 (54.7%) of these 42 patients. However, 21 (30.4%) patients in a group of 69 non-epileptic patients gave a response to the test which might have led to a diagnosis of epilepsy. These figures are slightly higher than those of Kaufman, Marshall and Walker (1947), initially, and they are also higher than those of Merlis, Henriksen and Grossman (1950), but the clinical activation rate and production of seizure discharges in non-epileptic patients is also higher. Therefore, the differences may be due to using a stronger concentration of metrazol. The positive findings are not so high as those of Cure, Rasmussen and Jasper (1948), using the slow injection method, but as has been written earlier, these workers were more concerned with the action of the drug on existing abnormalities than in the diagnosis of epilepsy.

There was no significant difference in the amount of metrazol required to produce epileptiform abnormalities in either group. In the series of proven epileptics, the mean /

mean dosage was 2.97 cc. of a 10% solution of metrazol, whereas in the non-epileptic group the mean dosage of metrazol was 2.95 cc. The epileptic discharge took the form of spike and wave activity in 48% of the epileptic group, and in 42% of the non-epileptic patients. Generalised seizures occurred in 16 patients in all (14.4%). Of these, 10 (43.4%) were in the epileptic group and 6 (28.5%) in the non-epileptic patients. The use of metrazol in this way is therefore no refinement on the work of Roismiser (1943) who produced generalised seizures in 32% of a group of epileptics with the rapid intravenous injection of 200 mgm. metrazol. He had to consider the fit as diagnostic evidence since he did not make use of the EEG.

The epileptic patients examined consisted of the following diagnostic categories :

Idiopathic epilepsy	Symptomatic epilepsy	Total	
14	9	23	Positive response.
16	5	21	Negative response.

However, the test was of localising value in only two of the 9 patients suffering from symptomatic epilepsy.

The great majority (i.e., more than 50%) of the non-epileptic patients who responded to the test in a positive way bore /

bore the diagnostic label of anxiety hysteria. This was by far the commonest diagnosis also in the non-epileptic group of patients who showed no positive response to the test. It is difficult to know whether this indicates a special relationship between epilepsy and anxiety hysteria, or whether this latter term is largely an indication of the diagnostic inadequacies of psychiatry. It is important that it should be determined which variety of hysteria has this relationship with epilepsy in view of the above findings, and also in view of the work of Gastaut and other French workers described earlier.

One interesting sidelight of the investigation has been the relatively high proportion of patients, in all diagnostic categories, involved in criminal proceedings. These have been tabulated thus :

	Total	Delinquents	Per cent.
Epileptics -			
With a positive metrazol response	23	6	26%
" " negative " "	19	3	15%
Non-epileptics -			
With a positive metrazol response	21	6	28%
" " negative " "	48	10	20.8%.

It is apparent that the proportion of delinquents is slightly higher in the groups giving a positive response to the test than in the other groups.

To /

To sum up : It seems likely that photic stimulation is of little value in the diagnosis of epilepsy. Sleep induced by "seconal" may be of value in selected cases, but this investigation has not supported that conclusion. Metrazol injected in divided doses, intravenously, according to the method of Gure, Rasmussen and Jasper (1948) produces some interesting results, but the induced seizure rate is as high as, if not higher than, that of the earlier workers who used metrazol as a diagnostic tool without the aid of the EEG. The efficacy of metrazol as a diagnostic agent depends to a large extent on careful selection of clinical material. Thus, in this present investigation, it produced epileptiform abnormalities in the EEG. records of 39.6% of 111 patients initially considered to be suffering from epilepsy. However, more detailed investigation showed that the technique had been of diagnostic value in 54.7% of 42 proven epileptic patients, although it had produced epileptiform abnormalities in 30.4% of a group of 69 patients suffering in the main from anxiety hysteria.

The variety of patients described here contains too few symptomatic epileptics to draw any definite conclusions of the value of the metrazol method in delineating focal abnormalities. It is apparent in the descriptions given, however, /

however, that the epileptiform abnormalities become generalised very rapidly indeed. Therefore, it is probably only true to say that the method is chiefly of value in the diagnosis of idiopathic epilepsy characterised by a bilaterally synchronous spike and wave discharge.

It has been pointed out already that the induced seizure rate in this present investigation is remarkably high. It is possible that this could be reduced by using a more dilute solution of metrazol, i.e., 5% instead of 10%. Then again, it is doubtful if the schedule of dosage in relation to body weight has any value other than that of inducing seizures in susceptible persons. In the paper appended to this thesis (Hutchinson, 1951) an analysis of 100 of these patients demonstrated that there was no significant correlation between the weight of the patient and the dosage of metrazol used. There is no doubt, as has been shown by Barker and Levine (1928), that there is a relationship between body weight and the rate of metabolism of metrazol, but these patients vary considerably in their degrees of cerebral instability, and there seems to be no close correlation between body weight and cerebral stability.

Therefore, it seems best to ignore the factor of dosage schedules based on body weight, and after the initial injection /

injection of 100 mgm. metrazol to proceed with the test by the injection of very small amounts of the drug in dilute solution at fairly regular intervals.

Perhaps the chief and final conclusion to be drawn from this investigation is that although metrazol is of value in demonstrating the tendency to convulse, latent in many patients, careful observation of clinical phenomena is the most reliable aid to diagnosis.

Acknowledgment

I am grateful to Dr. Denis Hill, Maudsley Hospital, London, and to Dr. William Sargant, St. Thomas's Hospital, London, for clinical facilities.

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