"NIGHT-BLINDNESS"—A PSYCHO-PHYSIOLOGICAL STUDY*

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Specific Psychological Data and Characteristics

Certain data commonly found in the whole series, regardless of the personality type concerned, appear worth recording.

1. *Eye Troubles in the Family.*—Of the total of 52 patients 9 stated that another member of the family suffered from night-blindness. In one of them, incidentally one of the best-adjusted of all, the patient's father, two brothers, and two sisters complained of the disorder. Complete blindness in near relatives was reported by 7, injury to the eye by 3, and severe anomalies of refraction by 8.

2. *Nervous Habits.*—Of the patients 23 were nail-biters as children, 1 a thumb-sucker, 15 were stutterers, and 23 were fastidious about their food; in all, 38 were either nail-biters or stutterers or were fussy about their food as children. As adults, 20 were still nail-biters (their nails were bitten down to the quick), 1 was a thumb-sucker, 9 suffered from speech disorders, and 15 were fussy about their food. Altogether 33 were nail-biters, had an impediment of speech, or were fussy about their food.

3. *Morbid Fears.*—If an allowance is made for minor degrees of fear of darkness ($\times$), which are so very common in children, fear that must be regarded as excessive ($\times \times$, $\times \times \times$) was found in 24 and very severe fear ($\times \times \times \times$) in 6 of the patients as children. It persisted into adult life to an unusual extent in 22 (very severely in 5). When on rare occasions they ventured out in the dark they kept to the middle of the road, unable to shake off a fear that men might be prowling about ready to pounce on them, and every harmless passer-by was regarded with fear and suspicion. Until they joined the Army four of the men slept with the light burning. The mother of one had to sit by his bedside until he fell asleep; another disturbed his comrades in the barrack-room by getting up at night to stoke the fire or switch on the light.

Unusual fear of injury was pronounced in 32 of the men as children and in 28 as adults. Afraid of getting hurt, they avoided fighting and rough games as children. As adults they are extremely careful in crossing roads and are generally told that they have too much sense of danger. They have an irrational fear of doctors, nurses, and hospitals, and are terrified of minor surgical operations. They cannot stand the sight of surgical instruments, blood, or accidents. An otherwise courageous man, a special constable before joining up, used to "shake like a leaf" if he had to take patients injured in accidents to hospital. Some have an unreasonable fear of dogs, others of being robbed of something precious (of what, they do not know). One man got into a state of panic each time his hair was cut.

In 5 of the patients concern about their eyesight appeared to be related to previous injury or severe visual disorder. In 12 others their fear of blindness was clearly irrational. Long before the onset of their night-blindness they took great care not to throw too much strain on their eyes, never took part in stone-throwing, kept out of dust-clouds, and wore eye-shades at their work. Even if they were of very limited means they con-

tributed generously to charities for the blind. One man always walked stooped; another was laughed at because he closed his eyes when boxing. An airman, previously fond of watching "dog fights" in the air, after his breakdown made himself "as small as possible" if enemy planes were overhead, and felt unable to look up. A man who previously had distinguished himself by bravery, after his breakdown went straight to bed when an air-raid warning was given, and covered his eyes with the blankets. Several of the men were terrified of bayonet practice because of potential injury to their eyes, and one made himself a laughing-stock by wearing his steel helmet all day long; he felt that it gave better protection to his eyes than the forage-cap.

Other fears often encountered in these patients are fear of heights, claustrophobia, fear of water, fire, contamination, and infection.

4. *Conflicts over Aggressiveness.*—Four of the patients were overtly over-aggressive in adolescence or adult life. Two of them liked to provoke brawls, in the course of which, however, they used to faint. Two were criminals: one of these, a practical joker, delighted in tipping water out of windows, tying people to chairs, or screaming in cinemas. The vast majority were unaggressive, over-compliant, soft-hearted individuals. In some of them their aggressiveness was more or less completely repressed. They could not bear to see anyone in pain. One, for example, had not visited the cinema for years because he could not bear the sight of atrocities on the screen. He took a job with the N.S.P.C.C., but had to give it up because he could not stand reading the reports. These men accordingly loathe warfare, and some of them considered seriously reasoning with the enemy if they came up against him. In others the repressed aggressiveness was expressed in fantasy. "Roaming through the fields alone all day," said one, "I would sit at my camp fire at night and think to myself: 'The last generation had a war, why shouldn't we?'" He fancied himself a great explorer, a soldier, a doctor in a slum practice, an adventurer on the high seas. One of the patients had chosen Napoleon as his hero, and another one, a puny little man, wanted to descend as a parachutist in the centre of Berlin and wreck buildings. A great number of men, displacing their aggressiveness from their inner world into the outer, suspected danger everywhere, and were, as already mentioned, subject to numerous morbid fears. Some of the men succeeded in diverting their aggressiveness into channels which were tolerable to them. Two of the most tender-hearted patients took to butchering, and another one similar in type, a solicitor, chose to prosecute people. Others, deprived of an external outlet for their aggressiveness and prone to self-punishing attitudes on account of their inner conflicts, directed their aggressiveness against themselves.

5. *Prying Interests, and Wish to be Taken Notice of.*—It is obvious that the interview method does not lend itself to a careful analysis of early prying interests. Only very few admitted early peeping pleasures. One of them, the practical joker, took a special delight in bathroom intrusions. The majority denied direct prying interests. More than one, however, had gone out of his way to take classes in human anatomy without actual professional interest in the study. Several had volunteered for first-aid work despite their professed horror at the sight of accidents. One made use of his position as an unqualified chemist's assistant to listen to the complaints of his customers and even to examine them. A surprisingly large number of patients (13) reported spontaneously that as children they had repeatedly been "ticked off" for their uncalled-for inquisitiveness and curiosity, and that later in life they had an unquenchable thirst for knowledge. With a perhaps relevant frequency they showed as children a predilection for visual activities, such as drawing, sketching, and model-making, which afterwards in some cases had definitely influenced or shaped their lives. In one patient a gross inhibition of visual activity had occurred early in life: he could not bear to look at the sky, and all his life had walked with his eyes fixed on the ground.

Similarly most of the patients were inhibited in their desire to be taken notice of. They liked to keep in the background, and if made the centre of attraction they felt uneasily all eyes focused on them. A fair number were unusually bashful in stripping in front of others. Six patients, by contrast, were only happy if they could show off.

* Concluded from page 575.

Mode of Onset

Nine patients stated that they had been night-blind since childhood, and in 16 it began later in life but before the war; 13 noted their first symptoms when the black-out started, and 14 in the course of the war. The onset was gradual in 31 and acute in 21 patients. No definite correlation between personality types and mode of onset could be established.

In four patients night-blindness started following some eye disease, injury to the eye, or eye operations which themselves, in the opinion of the eye specialist, did not account for the disturbance of night vision. In three cases it was preceded by a serious accident and was accompanied by various nervous symptoms. Eleven times it occurred in the course of a nervous breakdown, with which it was clearly connected. One man, a tin-worker, attributed its onset to the glare in the factory, but there was strong evidence in favour of the hysterical origin of the disorder.

The onset of night-blindness in the course of a nervous breakdown observed in eleven patients deserves special consideration. The setting, in four cases, was that of men of unusual gifts who, after tremendous efforts, came up against a situation which for different reasons was more than they could stand. One man developed an acute anxiety state with night-blindness as a prominent symptom when one day, after many years of happy married life, he caught his wife with his best friend as her lover. In six others their neurosis and night-blindness seemed to be precipitated by terrifying war experiences, such as the sight of mangled bodies, close friends killed in front of them, the sight of destruction of their much-treasured property, etc. Twice night-blindness which had existed since childhood was aggravated by similar circumstances. Here are some brief examples:

ACUTE ONSET

An aircraftman aged 19, who had lived a reckless life and had knocked about the world in an ocean tramp, enlisted in the marine section of the R.A.F. and his ship was blown up by a bomb. He struggled in the water, watching his comrades dying one by one, while he himself felt apathetic, unafraid, and ready to die. After his rescue and return to this country his symptoms came on; he became afraid of everything, was sleepless and unduly fatigued, and at the same time he noticed that his vision in the dark, on which he had formerly prided himself, rapidly deteriorated until he was night-blind.

Another man aged 21, grossly over-dependent as a child but afterwards ostentatiously independent and fond of taking risks and of gambling, had always been keen on aeroplane models and aeroplanes, and was fortunate in securing confidential work in the R.A.F. which thrilled him and gratified his inquisitive nature. On being posted to an aerodrome in a heavily bombed area he, however, was exposed to a severe raid in which a direct hit occurred near him, and he witnessed the spectacle of mangled bodies lying around. Some of his closest friends were among the fatally injured. After this incident he began to have nightmares, tremors, sleeplessness, headaches, and night-blindness. Formerly restless and thirsting for action, he has lost his confidence, ruminates on the fate of the shot-down enemy, reflecting: "These poor blokes had fathers, mothers, and sweethearts."

A corporal aged 29, averse to any "damaging mischief" as a child and professedly unaggressive and unduly soft-hearted throughout his life, chose butchering as his career. He studied anatomy and physiology of cattle in his spare time and, as his interest grew, took classes in human anatomy and physiology. When one of his colleagues disembowelled himself by accident he was completely unperturbed. "Blood is to the butchering business what water is to a man who works on the street mains," he said. The incident prompted him, however, to join the St. John Ambulance Brigade. Anxious to be exempted from the use of "aggressive weapons," in case of emergency he enlisted

in the Territorial R.A.M.C. before the outbreak of war. Fearlessly he attended the wounded under fire; while doing so, and just when lifting up a wounded officer, a bomb came down near him and killed the officer in his arms; in fact, the officer's body protected this man against the effect of blast. Shortly afterwards he began to suffer from night-blindness and photophobia.

CHRONIC ONSET

A soldier aged 21, quiet, retiring, shy, unaggressive, passive, and over-dependent, was pampered and spoilt by both his parents because of his delicate state of health. He is still nicknamed by his brothers and the neighbours "Mummy and Daddy's boy." He has always been haunted by morbid fears—fear of infection, of heights, and of policemen. If anyone speaks sharply to him he shakes all over. His main fear, however, is that of darkness. He has always slept with his head covered by the blanket, and he very rarely went out in the dark. His family lives at the top of a tenement. If, on rare occasions, he came home late at night, he called at the house of a neighbour, and she took him home, waiting at the bottom of the stairs until he had safely reached his parents' flat. The boys in the neighbourhood used to laugh at him about his timidity. He has always been short-sighted, and noticed difficulty in seeing in the dark for the first time when the black-out started. When he was on night patrol one of his comrades had to take his hand.

Another soldier, aged 25, had always had an intense longing for love. Resentful of the want of love at home, he repeatedly ran away, but he never got further than a few miles. As he was thin, weak, and miserable as a child, he was an easy prey for teasing and cruelty by other children. He envied other boys who were big and strong, and he hoped one day to be able to protect himself and others. His ambition was to be a boxer. He has always been terrified of darkness and unduly concerned about potential injury to his eyes. Until 12 years of age he was a bed-wetter, and he still sucks his little finger. After a weak attempt at work he gave it up at 16, and he has since been unemployed and unemployable. At 18 he fell off a tree during his first attempt at smoking, and ever since he has complained of backache. Two years ago he was seduced by his present wife. He has never been really potent. His wife called him daft, and said that he ought to be drowned. He somehow managed to get into the Army, but right from the beginning he has been unable to do any duty. N.C.O.s told him he should desert, as he would save money to the country. The patient's nervousness has become worse during the last six years. He complains of sleeplessness, anxiety, depression, and lack of memory. Both by day and by night he gets frightened—of what, he does not know. He has frequent nightmares, dreaming that black people are after him with spears. Before joining up he rarely left his house, because he was afraid of people. If anybody talks sharply to him he trembles and bursts into tears. He has repeatedly considered suicide, but for fear of hurting himself has always desisted from committing it. His night-blindness started two years ago in connexion with eczema of his eyelids.

One case may be given in slightly greater detail.

A soldier aged 25 lost his father when he was an infant. His father was reported to have been a "strong man"; once he had taken up a challenge to wrestle with a Russian bear in a show and had won a cup, which to the patient's great disappointment he failed to inherit. Stories about his father's feats were all the more awe-inspiring for the patient as he himself was sick and delicate as a child. Being of poor health and the only child, he was spoilt and pampered by his mother, to whom he was greatly attached. The punishing authority in the house was his grandmother, who, if he did something wrong, used to lock him in the cellar. "I used to scream the house down," he said.

As a boy the patient was timid, shy, retiring, over-sensitive, and easily reduced to tears. His only companion was a blind uncle, four years his senior. Working in a power station, this uncle had been "dazzled by the light and lost his eyesight." Children used to shout nicknames after them, and call them "Flash and Sparks." The thought that a fate similar to that of his uncle might one day await him struck him at times, and he used to think that he would rather kill himself than accept

anybody's help. In his spare time he liked to lend a helping hand to his mother, who often remarked that he should have been a girl. He preferred girls' company to that of boys. If on rare occasions he went out alone in the darkness he used to imagine that men were following him. "They might molest me; by that I mean force me into a car and kidnap me." Until 13 years of age he was a bed-wetter, and he is still a nail-biter.

For a time he thought of taking up boxing as a career, but being rather short-sighted and unable to see the ropes in the boxing ring, he "cut his throat" and had to give up the idea. He went into the cinema trade and became a re-winder. At 22 he joined the Regular Army "for adventure and excitement."

During the fighting in France he noticed the first nervous symptoms. He jumped at the least sound, trembled if he was addressed by N.C.O.s, and cried a great deal. The sight of "pieces of legs and trunks of men lying about" affected him very badly; he vomited frequently. On his return home people noticed that he had gone very thin; he rejected food and shunned company. He then went to Norway, where again he had a rough time. During a bayonet attack he stabbed three of the enemy and used the butt of the rifle freely. He wiped out two machine-gun nests by the use of hand-grenades. For bravery in this action he stated that he was recommended for the M.M. but did not receive it. Again the "ghastly sights" had a very bad effect on him. After the evacuation from Norway he made the acquaintance of his wife through a pen friendship, and he was more or less seduced by her. The morning after the first connexion with her he felt sore, and he had to hobble on two sticks for three days. Since their first intercourse his wife has refused herself to him and has been unfaithful to him. Although he realizes that he has made a wrong choice his only wish is to be reconciled to her, even if she should deny herself to him. Since then his nervousness has become worse; he shakes at the least noise and cries easily, and when air-raid alerts are sounded he goes to bed and covers his head with the blanket. During a recent leave he heard machine-gun practice; immediately he cowered down in a corner of the room. The patient is anxious to return to civilian life. He wishes to work in the telephone office in his home town, where among a number of women telephonists a job is waiting for him. He feels disappointed in the Army because his application to become a parachutist has been rejected. He would like to descend in the centre of Berlin and wreck important buildings. In case of an invasion he has planned to kill his family, his stepfather included, to prevent them from being raped.

His night-blindness started after an accident in Norway. One night his unit took shelter in the cellar of a house. As he came out of it the house was hit by a bomb and he was blown back into the cellar. Subsequently he was blind for two days, and ever since he has been unable to see in the darkness.

Psychopathology

It can be shown that all the patients examined were disturbed in the early stages of their emotional and instinctual development. Conflicts over dependence, over primitive aggressiveness, and over primitive sexual impulses were found to be prominent. Phenomenologically they were individuals who either had always been over-dependent on their mothers or had adopted an over-compensatory, reactive, and defensive attitude of virile independence. Their attitude towards their fathers was one of admiration mingled with fear and often overt hatred.

In the light of analytical knowledge, these facts, combined with the occurrence of nail-biting, stuttering, and food-fussiness in many of the patients, suggest an unresolved mother-child relationship which, originating at the breast level and continued into adult life, never lost its double-edged destructive and at the same time preserving character. These conflicts were accentuated when at a slightly later stage of development the patient encountered the conflicts arising from the triangular father-mother-son relationships. None of the patients passed through this phase successfully. A persistence of bisexual tendencies could be clearly seen in many of them. Their outward appearance of masculinity was often very delicately poised. On close examination it was found that underneath, throughout their whole lifetime, a continuous struggle against feminine and passive homosexual tendencies had been taking place.

Among their primitive sexual impulses which were prolonged into adult life, scopophilic and exhibitionistic tendencies, usually in a concealed but sometimes in a fairly overt form, were seen to be present to an unusual degree. The eyes of these patients became libidinized more than is usual. From time immemorial in folk-lore, mythology, and idiomatic language the close association between aggressiveness and seeing on the one hand and incorporating and seeing on the other has been generally recognized. The "evil eye" and the devouring look are well known. Moreover, the importance of the eye as a phallic symbol has been stressed by the analytical school. In consequence it seems conceivable that severe taboos imposed on early sexual impulses related to the eye, as in the classical myth of Oedipus, may lead to self-inflicted blinding—that is, night-blindness. The limitation of the patient's blindness to the night is not surprising, perhaps, when we consider that night is predominantly the time for sexual expression and that darkness is the best ally of the criminal aggressor. In keeping with this it can be shown in many instances that the onset of night-blindness was ushered in and often precipitated by a dramatic incident when the patient, confronted by the horrors of war, was unable to tolerate the sight of the fulfilment of his well-harboured and deeply repressed destructive fantasies. The onset also coincided with the collapse of a painfully and carefully created virile façade, which in the final breakdown gives way to complete feminine submission and reappearance of childlike dependence.

Discussion and Conclusions

1. *G. I. Scott*.—In only one of the 42 cases examined was there a true ocular cause for the symptom of night-blindness.

2. *B. Semeonoff*.—Although the number of subjects in the control group was small, fairly satisfactory standards of normal dark adaptation seem to have been established. There is a distinct break between the lowest adaptation measure (3.0) among the "B" cases in the control group and the cases classified as defective (2.1 and 1.0). In the night-blind group, again, the lowest "C" case (1.5) showed a marked difference from the highest of the "D" cases (0.8). If 3.0 is taken as the lower limit of approximately normal adaptation instead of 2.5, the lowest figure graded "B," 16 of the night-blind cases may be regarded as showing normal or near-normal adaptation. This number is raised to 24 if the remaining "B" cases are included. In other words, 40 to 60% of the night-blind men tested for dark adaptation showed little or no disturbance of this function.

This estimate is made independently of the ophthalmological findings, which account for certain of the cases of defective dark adaptation, and which have also revealed that the present method of testing, based on peripheral vision, was bound in certain cases to give very poor adaption-meter results.

3. *E. Wittkower, T. F. Rodger, and G. I. Scott*.—Of the 52 patients 34 were submitted to a joint ophthalmological,

FIG. 2.—Correlation between ophthalmic, dark-adaptation, and psychiatric findings.

I. No or minor ophthalmic findings; no or minor disturbances of dark adaptation.

II. Relevant ophthalmic findings; no or minor disturbances of dark adaptation (22 patients in Groups I and II).

III. No or minor ophthalmic findings; relevant disturbances of dark adaptation.

IV. Relevant ophthalmic findings; relevant disturbances of dark adaptation (12 patients in Groups III and IV).

psychological, and dark-adaptation examination (Fig. 2). Of the 34, 22—i.e., about two-thirds—had no disturbance of dark adaptation on testing or had disturbances within

the limits of those found in a control group of patients not complaining of night-blindness. Moderately high errors of refraction found in 6 of 22 men seem to be irrelevant for the disorder. Since the great majority of the 22 patients (20) suffered from fairly severe or very severe psychological disorders of a specific type, it is legitimate to assume that in these cases the complaint of night-blindness is of purely psychological origin.

Of the 34 patients 12—i.e., about one-third—had, on testing, disturbances of dark adaptation beyond the normal established by a study of a control group. This group is of particular interest and importance.

Of the four cases showing "severe" disturbances of dark adaptation three exhibited typical tubular "hysterical" fields, although they had no difficulty in orientating themselves in daylight. The remaining man had a marked "functional" disturbance of vision in that he would only admit vision equal to 4/60, although there was no ocular cause to explain such defective vision—i.e., the ocular findings in all of these cases showed evidence of marked functional disturbance.

Of the eight cases showing "moderate" disturbance of dark adaptation, correlation with the ocular findings gives the following results:

1. One case of retinitis pigmentosa—that is, a true ocular cause for the defect.
2. One case of corneal scarring, sufficient perhaps to explain the defect.
3. Two cases showed evidence of functional disturbance in that there was defective vision for which there was no ocular cause.
4. Four cases had no ocular cause for night-blindness and showed no ocular evidence of functional disturbance. Of these four, however, two revealed well-marked evidence (other than ocular) of psychiatric disorder, and one was a very definite case of hereditary night-blindness.

It is therefore unnecessary to assume the existence of vitamin A deficiency to explain the dark-adaptation results; and, indeed, the possibility of vitamin A deficiency can safely be excluded, as all the men had an ample vitamin A supply and, considering the severity of their disturbance of dark adaptation, should have had other objective evidence of vitamin A deficiency such as xerosis of the conjunctivae or Bitot spots. Such evidence, however, was absent. The fact that the dark-adaptation test revealed diminished adaptation in neurotic as well as organic ocular disorders shows that it cannot be relied upon to indicate vitamin A deficiency. It is probable, though hitherto unproven, that the results of dark-adaptation tests may be influenced by mental mechanisms.

On the basis of the present study we venture to express the opinion that night-blindness as seen in this country, though phenomenologically the same, is aetiologically quite distinct from night-blindness due to nutritional causes.

Summary

A series of 52 unselected soldiers complaining of night-blindness were examined ophthalmologically, psychiatrically, and by dark-adaptation tests.

A. Psychiatric Examination.—1. The great majority of the men were found to suffer from severe psychological disorders. Using a modified Culpin scale, the severity of their disorders was classified as Grade 1 in 9, as Grade 2 in 12, and as Grade 3 in 31 patients. Of the 43 patients in Grades 2 and 3, 27 suffered from acute and chronic anxiety states, 8 were cases of conversion hysteria, 4 were cases of depression, and 3 were psychopathic personalities of the schizoid or over-aggressive type. Most of the men, quite apart from their night-blindness, were found to be

unfit for military service because of their psychiatric abnormalities.

2. Of the 52 men 27 gave a lifelong history of over-dependence. They were perpetual children or men with strong feminine tendencies. In 12 others, though he-men in appearance, their ostentatious independence was reactive and over-compensatory in origin. The remaining 13 patients were mixed reaction types.

3. Certain characteristics—nervous habits (nail-biting, speech disorders, food-fussiness), morbid fears (excessive fear of darkness, fear of injury, especially to the eyes), conflicts over aggressiveness and abnormal prying interests—were commonly seen, and long antedated the onset of the disorder.

4. The onset was gradual in 31 and acute in 21 patients. It occurred in 11 patients in the course of a nervous breakdown. In 6 cases it was preceded by terrifying war experiences, such as the sight of mangled bodies.

5. The psychodynamics of the disorder were discussed.

B. Ophthalmological Examination.—Of the patients examined ophthalmologically 42 can be grouped as follows: (1) no ocular findings, 13; (2) one eye defective, other eye negative, 6; (3) minor errors of refraction, 11; (4) marked errors of refraction, 11; (5) severe eye anomalies, 1. In only one patient, a case of retinitis pigmentosa, was there a true ocular cause for the complaint of night-blindness.

C. Dark-adaptation Examination.—Dark-adaptation tests were carried out in 40 of the patients. Of these, 16 showed mild disturbances of dark adaptation and 9 showed none—i.e., in 25, as compared with a control group, the dark adaptation on testing was within the limits of the normal. Moderate disturbance of dark adaptation was found in 11 and severe disturbance in 4 patients.

D. Joint Examination.—1. Of 34 patients studied jointly 22 had no relevant disturbance of dark adaptation on testing. Almost all of them suffered from severe psychiatric disorders of a specific type. Of the remaining 12 patients with definite disturbances of dark adaptation on testing, one was a case of retinitis pigmentosa and another a case of hereditary night-blindness; in practically all of the others, although their psychiatric disorders appeared to be less severe than in the main group, were found severe disturbances of eye function which are generally regarded as "hysterical" (tubular fields, etc.).

2. No evidence of vitamin A deficiency as an aetiological factor in night-blindness could be obtained in the series studied. The value of dark-adaptation tests for the discovery of night-blind patients and as an indicator of vitamin A deficiency appears doubtful. Most cases of night-blindness seen in this country are probably of psychological origin.

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CLOSED-PLASTER TREATMENT OF BURNS OF THE EXTREMITIES

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The treatment of wounds by closed-plaster technique has received much attention of recent years. I have recently had the opportunity of applying the same form of treatment to cases of burns of the extremities admitted to an E.M.S. base hospital.

Following enemy action at sea a number of cases with burns caused by steam were admitted to this hospital. Of these, one which showed partial and full skin loss in feet and ankles was treated by the closed-plaster method seventeen hours after injury. Treatment consisted in cleansing with saline and removing blisters. All burnt areas were covered with vaselined gauze, and plaster-of-Paris was applied from the tips of the toes to the knees. The patient made an uneventful recovery. Plasters were removed on the fourteenth day, when the burnt areas were found to be completely healed and ankle movements were full and painless. A large number of cases which were involved in the same incident were admitted to a hospital elsewhere and were treated by various well-accepted methods. The interval between injury and initial treatment was from twelve to twenty-four hours. Some of these cases developed sepsis, and several were transferred to this hospital, at periods varying from three to twenty-one days after injury, for further treatment.

After admission here the closed-plaster method was applied only to grossly infected cases in which there was no regression of sepsis, the affected limbs being extremely painful on movement and in all instances showing joint deformities. No other method of selection was used for this series. In this manner 16 cases were treated—a total of 26 limbs, consisting of 11 hands and wrists, 3 wrists, 8 feet and ankles, and 4 complete upper extremities. No other form of treatment was applied either externally or internally, with the exception of silver nitrate to burn down the occasional small granulations and liquid paraffin

to maintain pliability of skin after the plasters were removed.

In trying to assess the extent of full skin destruction in the earlier cases a great deal of difficulty was encountered, particularly because of the superimposed infection present. All areas had definitely suffered partial skin destruction. The only occasion on which full skin destruction could be ascertained was when cases required more than one plaster application. An estimate was made from the size of areas of clean granulation tissue seen at the first plaster change. But by this time a large amount of epithelization had undoubtedly taken place, so an accurate estimate of the initial full skin destruction could not be made. Later cases did not offer so much difficulty, as the infection was in a chronic phase and granulating areas were present where there had been complete loss. How much of this was due to destruction by burning and how much to superimposed infection cannot be stated.

Method of Application

All cases were handled in the operating theatre; burnt areas were cleansed with saline, either by douche or sponge, and surrounding undamaged skin with soap and water. The affected areas were then covered with two thicknesses of gauze impregnated with petroleum jelly or liquid paraffin. Plasters were applied, and an endeavour was made to obtain absolute immobilization of the affected part by including the joint above and below it in the plaster. This was not possible in two cases in which the skin of the elbows and upper arms was involved. Absolute immobilization could only have been obtained by shoulder spicas, which were not warranted owing to the general condition of both patients at the time of application.

The position in which joints were immobilized varied with the position of the burnt area and the possibility of contracture formation. It also varied with the anticipated duration of treatment in plaster, bearing in mind that at each plaster change all joints were to be put up in positions different from the previous ones, so as to ensure as much mobility as possible when the areas healed. Early cases, in which a short period in plaster was anticipated, were put up in such a position as entirely to counteract the possibility of contracture. Where longer periods of immobilization seemed likely this was not attempted at the first application, the position being improved at change of plaster so as to reach an optimum position gradually.

A difficulty which arose with the ordinary methods of applying plaster was the danger of injury to the newly formed epithelium by cutting instruments. This was avoided by the use of plaster slabs, especially for hands and forearms. In these cases a palmar slab was applied from the finger-tips to the upper forearm, and was moulded with the joints in the desired position. When this had hardened the edges were greased with petroleum jelly. A dorsal slab was then applied and an ordinary gauze bandage wrapped around the forearm. The hand portion was well moulded between the fingers, which were previously separated by pieces of cotton-wool between the finger-tips. Extensions were made to include the elbow-joint and arm when desired. In this way the plaster could be removed easily by separating the slabs. In cases of feet and legs a fairly thick posterior slab and then circular plaster bandages to a thickness which could easily be cut with a plaster-knife were applied. These plasters included the toes, leaving only the extreme tips available for inspection. Plasters were changed every ten to fourteen days, depending on the amount of discharge and the condition of the plaster. The following outstanding features were noticed during the course of treatment by this method.