Deafness was very marked soon after the explosion, always most on the side exposed to the full force; when the shell burst in front or behind a patient, both ears were affected. Patients who had been buried seem to have suffered more than others. The initial degree of deafness following the concussion soon passed off. The noises were often noticed only later, after the first degree of deafness had passed off. It was not often that increase in deafness was stated; as a rule, only the addition of noises to the previous condition. When the hearing showed further marked improvement, the persistence of the noises was a common complaint. Some patients reported being unconscious for from one to two hours; then feeling in a dazed condition, inability to walk unassisted, staggering gait; others that they lost the power to speak, or could not see. All these maximum conditions appear to pass off quickly; the lesser conditions, giddiness and dizziness, were complained of for seven to ten to fourteen days—anyway while under observation. These cases showed a horizontal or rotatory nystagmus, or turning eyes to the right or left. It must be noted whether both right and left sides were likely to have been affected at the time, or right or left only. It will be noticed that when both sides are affected there was a nystagmus to the right and left; when one side was affected there was a nystagmus to the opposite side. (*Vide* Nos. 23, 47, 48, 52, 56, 78, and 83.)

(*To be continued.*)

SOCIETIES' PROCEEDINGS.

ROYAL SOCIETY OF MEDICINE—OTOLOGICAL SECTION.

Meeting on February 16, 1917.

H. J. MARRIAGE, *President of the Section, in the Chair.*

MEETING on War Injuries and Neuroses of Otolological Interest. For introductory papers, *see* JOURNAL OF LARYNGOLOGY, RHINOLOGY, AND OTOLOGY, June, 1917, p. 177, by H. J. Marriage, and November and December, 1917, pp. 340 and 369, by J. S. Fraser and Capt. J. Fraser.

(*Concluded from p. 60.*)

Major A. F. HURST, R.A.M.C.

As a result of my observations on cases of functional deafness, deaf-mutism and so-called "hyperacusis" in soldiers in the Neurological Section at Netley, I have come to certain conclusions as to their ætiology.

(1) *Deafness.*—The deafness is hysterical and due to auto-suggestion. The momentary deafness, which is the natural result of the terrific noise caused by the explosion of a big shell in the immediate neighbourhood, may make such an impression on the mind of a soldier that, on coming to himself, whether he has actually lost consciousness or not, his first thought is for his hearing, especially if it was already impaired by preceding disease, and he may be so convinced that he is permanently deafened that he becomes actually deaf as a result of auto-suggestion. Hearing necessitates listening. Inattention during a dull sermon results in total deafness to the sermon, and in hysterical deafness the patient is so convinced that he cannot hear that he does not listen; although the sound

vibrations reach the ear in the normal way, they do not give rise to the slightest auditory sensation because of this inattention. The synapses at one or more of the cell-stations in the auditory path to the cerebral cortex must therefore be unswitched, probably as a result of retraction of the dendrons. I shall presently show that the auditory-motor or "jump" reflex is a function of the mid-brain. In the absolute deafness of shell-shock this reflex is abolished or greatly diminished. A very nervous but totally deaf-mute remained completely unmoved, never jumping nor showing a flicker of his eyelid during one of the severest thunderstorms I have known, and yet the next day he was completely cured by suggestion. In some cases the reflex is present when first noted, but disappears more or less completely when the test is repeated. One of the unswitched synapses must therefore be below the mid-brain, and either in the auditory nucleus or less probably in one of the intermediate cell-stations—the superior olive or the nucleus of the lateral fillet. It is very much easier to cure pure mutism than pure hysterical deafness, because by simple persuasion and re-education the mute can be induced to use the muscles involved in speech, and in severer cases the excitement caused by some unexpected event, or by alcohol or ether, is enough to cause involuntary speech, for when once a word has been uttered involuntarily the mute is convinced that he is cured. If this occurs in a deaf-mute, the return of speech generally convinces him that he can also hear; he therefore listens, and the unswitched synapsis is once more switched on. Deafness without mutism in shell-shock is, in my opinion, almost always of the same nature and not due to any gross lesion of the labyrinth, as so far as I know this has never yet been proved to occur in the absence of external injury; the ruptured drum often seen is also of small importance, as it in no way influences the rapidity of recovery in hysterical deaf-mutism. In spite of this it is often exceedingly difficult to restore the hearing in the absence of mutism, and many cases have, I believe, been regarded as the result of some actual destructive lesion because of their persistence. In such cases suggestion under hypnosis almost always cures unless the deafness is so absolute that the patient cannot even hear shouting through an ear-trumpet, in which case it is impossible for suggestions to have any effect, as the unswitched synapsis remains unswitched in hypnosis, and commands, which in other hypnotised individuals are immediately obeyed, do not reach the cortical centre of hearing, and are, therefore, not obeyed. As I have found that hysterical manifestations, such as contractures and anæsthesia, disappear during sleep, it might be expected that hysterical deafness would behave in the same way, but this is not the case. Three men suffering from total hysterical deafness without other symptoms were put into a hut by themselves. During the night an alarm of fire was raised, but, in spite of shouting and banging a poker against a shovel within a few inches of their ears, neither of the two who were asleep when the ward was entered woke up. The auditory motor reflex occurred in one patient, in whom it was present when awake, but in the other, who had no such reflex when awake, it was absent.

(2) *Exaggerated Auditory Motor or Jump Reflex, so-called Hyperacusis.*—A sudden noise normally causes an individual to jump and blink, and at the same time his pupils dilate; the "jump," at any rate, is a protective reflex, and represents the preparation for flight or fight. An officer, whose left motor cortex had been almost completely destroyed went to see "The Man that Stayed at Home" about four months after he was wounded. His right arm jumped violently when the gunshot

rang out on the stage, although no trace of voluntary movement returned until three months later. The motor part of the reflex is thus sub-cortical. In war neuroses, in which the reflex is exaggerated, jumping continues during sleep and deep hypnosis, although the patient does not hear the noise which induces it, even in a dream. That the reflex is quite independent of actual hearing is shown by the fact that during deep hypnosis, with the eyes open, individuals in whom the reflex is normal or only slightly exaggerated do not jump or blink, and the pupils do not dilate even when a poker is banged against a shovel within a foot of the ear, although they answer even whispered questions and obey whispered commands.

I have already pointed out that the reflex is abolished in complete hysterical deafness, so it must occur above the synapsis, which is unswitched in this condition. This suggests that the reflex centre is in the posterior corpus quadrigeminum or medial corpus geniculatum, and the close relation of these centres to the blinking and the sympathetic pupillo-dilator centre in the neighbourhood of the third nerve nucleus and to the anterior corpus quadrigeminum and red nucleus, in each of which a descending motor track originates, gives an anatomical basis for this view.¹ The very common exaggeration of this reflex in soldiers suffering from certain war-neuroses is not, therefore, correctly described as hyperacusis, for the sense of hearing may be no sharper than normal, and actual hearing need not occur at all, as the reflex occurs when they are asleep and hypnotised; it is simply a part of the general exaggeration of the defensive reflexes, which is a very characteristic feature of those war-neuroses that are due rather to emotions than to the actual concussion of pure shell-shock. In severe cases the patient appears to be in extreme terror: he jumps violently and trembles from head to foot at the slightest sound, and raises his arm as if to protect his face from a blow and hides his head under the bedclothes when anybody approaches him. Terror is at first actually present, for the patient never ceases to think of the horrors he has passed through, and he constantly pictures them before him, while every sound reminds him of the bursting of shells. But after all trace of terror has disappeared as a result of suggestion under hypnosis, and the patient no longer thinks or dreams of the horrors of war, the appearance of terror may continue unabated. This is due to jumping and flinching being defensive reflexes; the intense emotions to which the patient has been subjected leads to such an increase in the excitability of the central nervous system that the exaggerated reflexes persist after the cause of their exaggeration has disappeared. In one severe case true hyperacusis was also present, and Capt. Peters estimated that the patient heard sixteen times more acutely than the average normal individual. The hyperacusis and exaggerated defence reflexes were entirely uninfluenced by the administration of 100 gr. of bromide a day. The possibility of the jump reflex occurring in the absence of actual hearing, and being absent when hearing is not abolished, is of some practical importance, as I understand that the presence or absence of the reflex is often used as a test of complete deafness in mute children and in supposed malingerers, whereas its presence is not really a proof that actual hearing occurs.

¹ Since this note was written Professor C. S. Sherrington tells me that he and Forbes found that an incomplete jump reflex occurs in the decerebrated cat, and that both the posterior corpus quadrigeminum and medial corpus geniculatum were concerned in the reflex.

Mr. E. D. D. DAVIS.

My experience agrees with what you have said, Sir. But there is one question I would like to ask Dr. Gordon Wilson—namely, the difference between nystagmus of cerebellar injury, and that due to injury of the labyrinth.

Lieut.-Col. GOLDSMITH, C.A.M.C.

I shall address myself to the question asked by Dr. Grant, as to the amount of hearing necessary for a man to be in the Service, and the question of middle-ear suppuration. It is laid down in the Army Council instructions what amount of sight a recruit must have in order to be considered fit. That standard has been lowered as man-power has become more necessary. But the amount of acuity of hearing necessary has not been laid down, nor is it possible to lay down in an accurate way. The Canadian Army Medical Service has tried to lay down how far off a man should hear conversation voice in order for him to be placed in A, B, or C classes respectively. A man who hears ordinary conversation 15 ft. away in each ear, and who has no organic disease of the ear, can be accounted fit for Class A. But it must be known with certainty that the other ear has been carefully closed during the test and that the speaker has not been seen, because many men in the course of years have learned to get along by lip-reading. If a man who is at all deaf is put in a listening post, he may seriously endanger his company. If he can hear a conversation at 21 ft. with one ear and is deaf in the other, he is also classed A. The Canadian regulations are as follows:

Hearing and Nasal Condition.—Category "A": A soldier who can hear 15 ft. or better in each ear by ordinary voice, and who has no organic disease of the ear, shall be placed in Category "A." A soldier who has hearing of 21 ft. in either ear, but with little or no hearing in the other ear, but without active organic disease, shall be placed in Category "A." No soldier with a discharge from his ears shall be placed in Category "A."

Category "B": A soldier who has hearing of 15 ft. in either ear and little or no hearing in the other ear, and has no active disease in either ear, will be placed in Category "B" (i). A soldier who has better hearing than 12 ft. in each ear, but has a discharge from either ear of a moderate degree, or is subject to frequent recurrent discharge from the ears, of a moderate degree, may be placed in Category "B."

Category "C": Soldiers who show symptoms of chronic ear conditions, such as hearing reduced to less than 15 ft., with freely discharging ear or ears, or shell concussion deafness, shall be placed in Category "C." A soldier who has fully and recently recovered from a mastoid operation shall be placed in Category "C" for three months and then regraded.

Category "E": Cases that show repeated signs of recurring serious ear conditions, such as recurring mastoid pain, free formation of granulation tissue, indications of bone disease, or free, full, and offensive discharge from the ears, should be reported upon by an otologist, with a view to being placed in Category "E" for discharge as permanently unfit.

Nasal Condition.—Soldiers suffering from severe nasal obstruction should be sent to a specialist medical officer in charge of ear, nose, and throat diseases attached to one of the Canadian Military Hospitals, for

report, and if necessary, treatment, before being sent overseas, as it is found that such cases find it difficult, and in some cases impossible, to wear respirators.

Tonsils.—Enlarged tonsils which were present previously to enlistment should not be removed unless they show signs of chronic inflammation, or recurring acute attacks of inflammation interfering with Active Military Service. All cases, other than above, should be placed in Category "A." Where the removal of chronically inflamed tonsils will fit a soldier for Category "A," operation should be performed.

With regard to middle-ear suppuration, it is laid down in the Canadian Services—and I do not agree with it—that a man with middle-ear suppuration is not to be sent to France. Because a man has had discharge from his ear, it does not follow that he will "go sick" with it, and it will not do to say he is liable to mastoiditis or brain abscess, or acute suppurative labyrinthitis, since he is much more liable to be shot. A man whose hearing allows him to "carry on," and who has no active inflammatory condition in any of the surrounding structures, such as the labyrinth, the mastoid, or lateral sinus, can quite well go to France. And if you were now to bring from France all the men with chronic middle-ear suppuration, you would have battalions of them all over the country. In Boulogne, in 1914, I removed polypi which projected from the meatus, from dozens of men, and sent them back to the Front. They had some discharge from the ear, but it was able to escape, and the men continued to be just as good soldiers. As the demand for men becomes greater, aurists should not put greater difficulties in obtaining men in the way of the military authorities. A man may have middle-ear suppuration for years without it causing him trouble, and the Regimental Medical Officer should not allow him to make use of it as an excuse to be sent back.

So far as concussion is concerned, it has struck me, on examining many of these cases, particularly for medical boards, that if you go into the history you will find many of the men have had deafness before the war, and their drums will show evidences of it, and particularly in that type of chronic middle-ear deafness with open Eustachian tubes and thickened drums, in patients who hear better in a noise but are not of the type called pure otosclerotics. These matters will be of great importance when dealing with pensions boards. If a man has been deaf before the war, and has been a lip-reader, that fact should be stated in reports. The amount of disability is based upon those reports, and it is very necessary that the aural report should be complete. If it says a man can hear ordinary conversation at 11 ft. with one ear, the word used in the examination should be stated, because when the case comes for review from the standpoint of a pension, someone else will examine him, and the same word should be used, otherwise the patient may say he is worse. I think Politzer's acumeter should be used in all these cases. At the present time these matters are carelessly recorded.

In recording the tuning-fork tests, which I think should be done, particularly in pensionable cases, so that a record for future comparison may be obtained, it is necessary when stating the result of the Rinne test to do so with two forks, C. 512 and C. 256, and to record how many seconds plus or minus. Furthermore, it is of value to record the low and the high limit. The high limit should be stated not by naming the highest fork heard, since this will probably not be more than C. 3012, but by recording the monochord reading, which definitely registers the

upper limit. In special cases labyrinthine tests will be required, and even a neurological examination. Schwabach's test should be similarly recorded, and it is to be remembered that in cases of neurasthenic deafness the fatigue period is particularly noticeable. Many cases of perceptive deafness hear all the high forks but for a shortened period, and it will add to the accuracy of the report if this record is made.

Experienced aural surgeons should make the special reports on ear cases just as ophthalmic surgeons are so required to do in Chelsea Board cases, so that there will be a definite record of the man's condition. This will be invaluable to those who have to report a second time, when the pensioner comes up for review, and will ensure that while the State is more carefully protected, the man suffers no injustice.

One should be very guarded in advising nose and throat operations during war time. I am sure a great many officers and men have undergone operative treatment for conditions which have existed before the war, and in whom active service has produced some increase of discomfort or inconvenience, but not enough for their state to be classed as a *disability*. The real disability is the operation itself, which entails that the State loses the services of the soldier for many weeks. My own opinion regarding us Canadians is that we do not react very well, after nose and throat operations, in this country unless we have been here a considerable time. Our soldiers are all subject to an increase in their rhinitis and rhino-pharyngitis, which will subside in warmer weather. I have seen many cases of officers and men who have returned from France with various wounds, whose stay in hospital has enabled a long-standing nasal condition to be discovered, and who have undergone operative treatment even though no disability has been present. In civil life we are quite justified in relieving discomfort and inconveniences in our patients if they wish for such relief, but in military life the services of the soldier belong to the State and we should be very careful that we do not take too much liberty with such services. Furthermore, I wish to draw your attention to the responsibility each one of us assumes when answering the question as to whether the disability is the result of active service, or whether it is aggravated by it.

MR. HUNTER TOD.

My experience of these cases, although not so great as that of others, as I am not attached to a military hospital, has been that bone disease, the result of direct injury by bullet or shell fragments, is more difficult to cure than in civil cases because of its more septic nature.

Partial nerve-deafness and tinnitus, unaccompanied by any lesion of the tympanic membrane, is not uncommonly caused by the explosion of shells or from a projectile passing close to the ear. This was well shown in one case, that of a sailor, in which the tragus was taken off and the concha pierced by a bullet which just grazed the side of the head. In association with the traumatic perforations, tinnitus seems to be the chief subjective symptom, especially in regard to prognosis. What answer can we give to the repeated question: "When will the noises cease?"

I am interested in what has been said about the caloric test. It is a very important test with regard to prognosis in internal ear concussion, and therefore also from the point of view of pensions. I had an officer who came to me shortly after the beginning of the war who was completely deaf for all sounds—the result of shell concussion—and he

had been so for three months. He took a long time to react to the caloric test, but as he gave a mild reaction I told him, although I then had no experience to guide me, that he would probably recover his hearing. He went to Scotland, and I understand that his hearing is now practically normal.

In answer to Dr. Dundas Grant, there is no standard of hearing for our Army. I once applied for a definite statement as to the standard of hearing required for recruits, but the only answer I received was that the hearing should be good.

In cases of middle-ear suppuration we surely should take the same sensible view as in civil practice—for instance, when testing for insurance. If there is perforation of the membrane, but no sign of bone disease, there is no harm in sending a man out to the Front. If there is bone disease of the tympanic cavity or its walls, or signs of chronic mastoid disease, I would not send him out, because even if the soldier has no serious symptoms at the time of examination, he will be a nuisance to the medical men at the Front.

I take advantage of this meeting to suggest that we might combine in representing to the Army Council that we should be better represented in the Army, and that aural consultants should be appointed.

MR. SOMERVILLE HASTINGS.

Since the beginning of the war I have seen a good many cases of injury at two fair-sized hospitals, and what has struck me most is, the amount of injury the normal ear will stand without permanent affection of the hearing power. I have seen comparatively few cases in which I could be sure the membrana tympani had been recently ruptured. Very many cases of perforation have come under my notice in which the deafness was stated to have followed a recent injury, but in only a few of these did the appearances agree with this. I have also noticed the frequency with which both types of concussion deafness occur in ears already injured by perforations without discharge, or by thickening of the drum, or scarring. Another point which has not been mentioned to-night is, I think, the frequency of cases of suppuration in which one gets a history that when the patient was a child suppuration in the ear occurred for a time, or in which there may be a large perforation with no history of suppuration at all. And yet suppuration starts again after a concussion, or after the man has been blown up by a shell, or buried in a trench.

THE PRESIDENT.

In the interesting discussion we have had many important points have been brought forward. I do not profess to be able to answer the questions which have been asked, as I have not had sufficient experience, my main work in connection with the wounded having been general surgery. This discussion has opened up fresh points for us to think over