eral population, Flack's cases consisted exclusively of adults of the military personnel.

Other Local Methods of Treatment.—The serum treatment has not made its way without opposition and more or less fluctuation of favor. It is very desirable that this fact be emphasized, because the same circumstances which have for a time carried the treatment backward in the past may operate again and suffice to do so in the future—and this notwithstanding the favorable figures given above.

To succeed with the serum, first a potent product must be available; second, it must be applied promptly and in a systematic manner. The chief obstacle to success with the serum has been imperfectly prepared, and hence impotent samples of the serum. The only way to avoid that particular misfortune is for the federal government to establish and enforce standardization. The disappointments and calamities of the English experiences early in the war, fortunately retrieved afterward when potent serum became available, arose from worthless commercial products.

Prior to the introduction of serum therapy, two methods of local treatment had been used.

(a) Frequent evacuation of the cerebrospinal fluid by means of repeated lumbar punctures. The effects following the procedure have been widely discussed, and seem to consist mainly in the relief of pressure, which is often very grateful to the patient. The termination of the disease has not been essentially affected. This is also the view of Netter, Goepfert and others who studied the epidemic at its height during 1904-1910. Indeed, it was during the period of high mortality that the method was chiefly employed in routine treatment. With the failure due to impotent serum, in England in 1915 repeated lumbar puncture was again resorted to. It was strongly recommended in some quarters,¹⁸ and all the benefits desired from the serum were even attributed to its effects.

(b) The injection of chemicals such as lysol and protargol into the meninges. There are experimental reasons for believing that the introduction of chemical antiseptics into the subarachnoid space is capable of doing distinct harm.¹⁹

(To be continued)

18. Foster, M., and Gaskell, J. F.: Cerebrospinal Fever, Cambridge, 1916.

19. Flexner, Simon, and Amoss, H. L.: Jour. Exper. Med., 1915, 23, 683.

Accident Prevention and Welfare Work in a Large Industrial Plant.—The *General Electric Review* describes the organization and work of the medical department of the Schenectady plant of the General Electric Company which was inaugurated in 1907. Complete records have been kept since that time. In the first half of this period there were twelve fatal accidents, an average of 2.4 per year. In the last half, that is, up to and including 1916, the fatalities decreased to an average of 2 per year, while in the last five years the number of employees has increased 25 per cent. From 1907 to 1911 one man out of 6,100 met with a fatal accident, while in the last five years only 1 in 9,000 occurred. In 1916 the fatalities were 1 in 10,000. In the latter year 13,716 examinations were made. Every employee in every department is accepted only through the medical department. An accident in the Schenectady works means every case of injury even though only a scratch, and must have the attention of the medical department to prevent infection. In 1916 there were 13,190 accidents of all degrees of severity, but only 36 were bed cases and only 11 serious enough to require an ambulance call. Out of 21,000 men working with steam, electricity and machinery of all kinds only two were killed.

Military Medicine and Surgery

TRENCH FEVER

PRELIMINARY REPORT

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During the past few months it has been my good fortune to observe several hundred cases of this extremely prevalent, carefully studied, but yet undetermined infection, known as trench fever. The name is really a misnomer. At first it was considered a result of trench life, and traumatic periostitis of the tibiae was thought to be the underlying pathologic process. Today we know that it develops in troops that have not experienced trench work; indeed, it develops sporadically in individuals who have only occasionally visited training camps and convalescent hospitals.

This so-called trench fever is a distinct clinical entity, and may be defined as an acute infectious disease of unknown etiology and self-limited course, characterized clinically by cyclic febrile attacks, intense headache and backache, and pains over the tibiae which are particularly severe at night.

Etiology.—The specific cause has not been determined. Diplococci have occasionally been found in blood cultures; a spirochete has also been described, but neither is constant. The possibility that lice act as the intermediate host is not remote. One attack does not produce immunity.

Symptoms.—After a short incubation, during which period the patient may complain of slight indisposition, the disease is ushered in with a sharp rise of temperature to from 101 to 104 F., which may be preceded by chilly sensations, rarely by a true rigor and occasionally by vomiting, and is followed by headache, usually frontal, intense backache, and continuous and often excruciating pain over the tibia, with nocturnal exacerbations.

The fever is quite characteristic in the individual case. After a sudden rise the temperature reaches normal in the majority of cases in from twenty-four to ninety-six hours. An afebrile period lasting from one to several days, sometimes a week, follows, and this in turn is followed by another febrile exacerbation. This cycle is repeated a number of times, but it has been my experience that in a large percentage of cases the temperature is inclined to remain normal after the third rise. As in other acute febrile diseases, I have met abortive cases in which the temperature reaches normal quickly after the initial rise, and does not again become elevated; also cases with more or less continuous fever, with slight remissions, closely resembling typhoid.

Shin Pains.—Of all symptoms of the disease, the shin pains are the most characteristic. They appear early, are constant, extremely distressing, particularly at night, do not yield to therapy, and often persist for months after all other evidences of the disease have disappeared.

Blood.—As I have stated above, no specific organism has been isolated. Lieut. Marcus Neal, our pathologist, has occasionally been able to grow, by blood

culture, a diplococcus, but not sufficiently often to justify definite conclusions. He has not observed the spirochete described by some British writers. The blood picture, however, is fairly characteristic. During the febrile stage the leukocyte count reaches from 14,000 to 16,000 and drops to about 10,000 in the afebrile period. The large mononuclear lymphocytes are increased to from 15 to 25 per cent., and the polymorphonuclears are proportionately reduced.

Genito-Urinary Tract.—The urinary findings during the febrile stage resemble those found in other acute infections, namely, decreased amount, high specific gravity, frequently albumin, and in severe cases hyaline and coarsely granular casts and red blood cells. With the drop in temperature, there is polyuria. The casts frequently persist long after the albumin has disappeared. True nephritis has not been frequent in my experience.

Other Symptoms.—Sweating occasionally occurs, and herpes urticaria and roseolae are rare. The sensorium is practically always clear. I have never witnessed delirium. Insomnia is common, but is due to the shin pains.

Diagnosis.—The diagnosis is made by recognizing the cardinal symptoms, namely, the typical fever curve, the shin pains, and the increase of the large mononuclear lymphocytes in the blood. Physical examination reveals marked tenderness over the tibiae, with rarely edema of the overlying skin. The spleen is not enlarged, but palpation over the splenic area elicits marked tenderness. Heart, lungs, joints, glands and reflexes reveal no abnormality.

When we consider the prevalence of this disease among the hardened and acclimated troops of our allies, it is fair to presume that our own men will be highly susceptible, unaccustomed as they will be to the work to which they will be subjected, to climate totally unlike that which they have previously experienced, and to sanitary conditions sometimes far from ideal.

THE PREVENTION OF SO-CALLED "SHELL SHOCK"

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"Shell shock" includes such a large proportion of the casualties in trench warfare that the advantage that would accrue from its prevention, if possible, needs no argument. It has been said that it causes the greatest percentage of disabling "casualties" outside of wounds. The exact number of cases probably has never been determined, for the question becomes largely one of diagnosis and classification. The personal equation of the surgeon who makes the diagnosis is a large factor. The neurasthenic type, for instance, is often classified as general exhaustion and breakdown instead of being ascribed to its true cause, shell shock. The plan which I propose for its prevention is based (1) on quite extensive personal studies of cases made at the front and in the base hospitals in France and England, where I became familiar with the disease as it occurs in the present war, and (2) on my general knowledge of traumatic neurosis obtained through many years of professional study and practice.

NATURE OF THE DISEASE

It is now the consensus of opinion that true shell shock, as distinguished from pseudo shell shock, differs in no way from the ordinary traumatic neurosis as observed after railway and other accidents, earthquakes, etc. Trench warfare seems, however, to have developed certain types which are more frequent than in the accidents of civil life, although they also occur there.

Being a traumatic neurosis, it is accordingly nothing but traumatic hysteria. Types vary all the way from neurasthenia to profound paralyses and anesthetics.

Among the cases erroneously classified as shell shock are undoubtedly many of an organic nature, due to actual injuries of the brain and spinal cord resulting from the soldier being violently thrown against some object, or from some other physical trauma. Some perhaps are due to gas poisoning, and it is possible that some may be due to the sudden compression and rarefaction of the air. This, however, has not yet been proved. All such cases should be classified as pseudo shell shock. Much misunderstanding has arisen from confusing them with the hysterical type which undoubtedly comprises the vast majority of cases.

CAUSATION

Causation, from the point of view of prevention, is of the utmost importance. The causative factor is unquestionably psychic, that is, fear acting in a mind already prepared by environmental influences for the final results. This preparedness of the mind to be influenced functionally under certain traumatic conditions, as a mental factor cooperating with the exciting fear factor, is also found in the civil cases. Thus, it has been found that in railroad accidents very few of the employees (generally given as 0.5 per cent.) suffer from traumatic neurosis, while a very large proportion of the passengers exposed do so suffer. Likewise, I believe that traumatic neurosis is rarely observed on board battleships following the explosion of shells, although it is obvious that the traumatic conditions are similar to those obtaining in trench warfare.

Shell shock should be more properly described as "shell fear" or "shell funk."

The theory on which any method of prevention must be based is that there exists among soldiers an anticipatory fear of what will happen when exposed to the explosion of shells, even when they are not physically hit or injured. Anticipatory fear has been created by the environment, that is, by the common belief of their comrades, the attitude of mind, point of view, etc., shared by those with whom the soldiers come in contact, which would include the medical officers as well as the military officers. It has been reported to me, although not directly from one in authority, that cases have occurred in men before they reached the trenches and before they had been under fire, and that these cases were due to anticipatory fear.

The present general belief among soldiers is that shell shock is due to physical injury of the brain, that from the mere concussion of the air produced by a high explosive shell they are likely to be seriously injured in mind and body (loss of memory, dumbness, paralysis, etc.), and furthermore, that when this hysterical state has been produced, they are more or less permanently incapacitated.

In other words, the soldiers' idea is much like that which used to prevail regarding the pathology of