TETANUS BACILLUS RECOVERED FROM THE SCAR TEN YEARS AFTER AN ATTACK OF POST-OPERATIVE TETANUS

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In 1928 a young unmarried woman aged 31 was admitted into the Royal Masonic Hospital under one of us (V. B.) with a large mass of uterine fibroids reaching to the umbilicus. He performed myomectomy, enucleating fifty-three tumours from the uterus and then reconstructing it. The suture material used was composed of strands of catgut and very fine silk interwoven. Fifteen days after the operation the patient complained of not being able to open her mouth, difficulty in swallowing, rheumatic pains, and stiffness of the posterior cervical muscles, and in a short time all the typical features of tetanus presented themselves.

She was placed under the care of C. B., who carried out intensive serum treatment. Cistern puncture was performed three times, 20,000 units of anti-tetanic serum being injected on each occasion, and, in addition, the patient was given a total of 26,000 units by two intrathecal injections and a total of 9,000 units by two intramuscular injections. Morphine, heroin, chloral, and bromide of potassium were also administered. As the result of this treatment, and after a period of great anxiety, the spasms diminished and she eventually completely recovered. The abdominal wound healed by first intention, and the condition of the uterus did not appear at any time to be unsatisfactory. The discharge from the uterus and the unused remainder of the suture material employed at the operation were examined for *Cl. tetani*, but it was not found, and therefore the diagnosis of tetanus rested on the clinical picture, which was unmistakable.

Early in 1938 the patient, now aged 41 and still unmarried, came to see V. B. because for the last year she had noticed her abdomen enlarging. He found a large mass of new fibroids and advised subtotal hysterectomy. The possibility that the spores of *Cl. tetani* might still exist in the uterus or the abdominal scar occurred to him, and he communicated with C. B. on the matter. The latter strongly advised a prophylactic dose of anti-tetanic serum after the patient had been protected against anaphylaxis by desensitizing her.

She was admitted to Hammersmith Hospital, where, after the precautions mentioned had been carried out, V. B. opened the abdomen through the old scar and performed subtotal hysterectomy, at the termination of which he excised with scissors, in two strips, the whole thickness of the abdominal scar tissue. After the operation two further prophylactic injections of anti-tetanic serum were given. The patient made an uninterrupted recovery except for a certain amount of joint and muscle pain, which was judged to be the result of the serum.

Bacteriological Findings

The specimen submitted to the bacteriologist (J. MacL.) consisted of a portion of the uterine wall and two strips of scar tissue, including the skin and the whole thickness of the abdominal wall.

These were finely minced up by means of sterile scissors, inoculated into a series of tubes of cooked meat medium and of glucose blood broth, and incubated anaerobically for forty-eight hours at 37° C. At the end of this period there was some slight growth of a coccus in one tube only, but after a further two days' incubation all six cultures made from the operation scar gave considerable growth of typical slender bacilli with round terminal spores: in one of the tubes these were apparently in pure culture, in four there was in addition *Staph. albus*, and in one *Staph. albus* and *Cl. sporogenes*. The cocci were destroyed by heat and the drumstick bacilli readily isolated by the method of Fildes (1925). Apart from some scanty growth of *Staph. albus* in two of the tubes the cultures made from the uterine wall remained sterile after one month's anaerobic incubation, and were then discarded.

The six cultures obtained from the scar tissues were examined and compared in considerable detail, and were found to be quite indistinguishable. It was assumed, therefore, that one strain alone was involved. This was in all respects a perfectly typical tetanus bacillus. In view of this it would be unnecessary to detail the morphological and cultural investigations. Toxigenicity was tested for in a series of mice. Intramuscular inoculation of 0.25 c.cm. of a twenty-four-hour broth culture produced spasm and death in from twenty-four to forty-eight hours; previous injection of a similar amount of anti-tetanic serum invariably gave complete protection.

By agglutination tests with sera prepared against the nine types of *Cl. tetani* the organism proved to belong to Tulloch's Type III; incidentally it was one of the comparatively uncommon Type III strains which do not agglutinate spontaneously in saline suspension. Apart from the Type VI strains (which are non-motile) this differentiation of *Cl. tetani* into various serological groups depends very largely, if not entirely, on the flagellar antigens. The heat-stable "O" agglutinins of *Cl. tetani* have recently been studied by Gunnison (1937). Heated suspensions of our strain were tested out against "O" antisera of the nine types. The results are in complete agreement with those obtained by Gunnison with her Type III strains—that is, it possessed the "O" antigen common to all nine types, but not the additional heat-stable component found in toxigenic strains of Types II, IV, V, and IX. To sum up: after presumably ten years in the spore form this strain of *Cl. tetani* showed no difference from other representative strains in its morphology, cultural characters, toxigenicity, or antigenic composition.

In view of the long time that the organism had remained in the tissues it was thought of interest to investigate whether any antibody response had been evoked in the patient. Unfortunately she had received several hundred units of anti-tetanic serum before the bacilli had been identified, so that any investigations from that standpoint were impossible. However, it has been suggested that in tetanus an actual anti-bacterial immunity may be developed, and in support of this Ten Broeck and Bauer (1923) and Condrea (1937) have demonstrated naturally occurring agglutinins in man and certain animals. The patient's serum was tested for the presence of "H" and "O" agglutinins against the original strain and against

representatives of all nine serological types with completely negative results. In addition her serum was tested against a suspension of the original strain which had been allowed to spore very freely, but no reaction could be detected either by agglutination or by complement-fixation technique.

Discussion

Comparatively early in the study of the bacteriology of tetanus it was realized that the spores of the bacillus had very great powers of resistance. Thus von Eiselsberg (1888) reported that a splinter of wood which had caused tetanus in a boy was capable of infecting rabbits two years later, and Henrijean (1891) recorded similar results after an interval of eleven years. As regards survival within the animal body opinion was much more guarded. It is true that Vaillard and Rouget (1892), Tarozzi (1906), and others had shown experimentally that spores might lie dormant in the tissues for several months, yet this was generally looked upon as quite exceptional, and it was not until the war, and after, that a number of cases of tetanus were recorded in which the primary infection had occurred months or even years previously.

The longest latent period about which there can be little doubt is in the case reported by Ernst (1931) in which tetanus developed fourteen years after the original war injury, but intervals of seven years (Brunzel, 1929) and four and a half years (Kaposi, 1917) are also on record. None of these cases, however, are comparable with our case, for in all of them the symptoms of tetanus developed first and then a possible source of previous infection was sought. For instance, in Ernst's case a wad had remained embedded in the tissues of the hand for fourteen years but without any symptoms. The patient then accidentally crushed his hand, but without breaking the skin, and developed tetanus, the spores of the organism presumably having lain dormant in the wad.

In post-operative "catgut" tetanus examination of the remainder of the ligature material used and of the discharge from the operation area has often failed to show *Cl. tetani*, and it has been suggested that the condition is not true tetanus, but in the case we now publish the findings show that it certainly was. They also show how important it is, even after the lapse of many years, to take anti-tetanic precautions when operating on a patient who has previously had tetanus.

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THE RISING INCIDENCE OF PSYCHOSOMATIC ILLNESS

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The increase in incapacitating sickness, its maintenance at a high level, and the growth of chronic invalidism among insured persons have puzzled many commentators, both lay and medical. Recent inquiries by the Regional Medical Staff of the Department of Health for Scotland have shown that the mass of chronic incapacity in that country may be regarded as "genuine" (McKinlay, 1937). In a previous study (1935) of the incidence of psychoneurotic illness I wrote: "It is interesting to speculate how far the rise in the rate of incapacity among insured persons during the last ten years has been due to an increased prevalence of psychoneurotic disability." The present paper—an analysis of morbidity statistics—shows that in the light of modern knowledge the only possible interpretation of the maintenance of the present high sickness rates is an increase in psychoneurotic and psychosomatic illness.

Note on the Term "Psychosomatic Illness."—The words "psychoneurotic illness" suggest, *inter alia*, the absence of structural change. Recent researches, however, have shown that emotional reaction may bring about changes not only in function but also in structure (Dunbar, 1935). A more appropriate term for disorders of this nature—whether (to use medical jargon) they are "cases of functional disease" or "cases of organic disease"—is "psychosomatic illness." This term is cumbersome but useful. It connotes both an aetiology and a mechanism. As regards aetiology, it indicates that the external agents which provoked the reaction of illness were of a special kind, being neither physical nor chemical nor micro-organic, but psychological—as, for example, the loss of a beloved object. As regards mechanism, it indicates that the external agent is encountered by the individual, not directly by the outer or inner surfaces of the body, such as the skin or mucous membranes, but indirectly, via the special senses and the integrating mechanism of the diencephalon, autonomic nervous system, and endocrine glands. This triad is sometimes called the psycho-neuro-endocrine system or the "bodily mechanism of emotion." By its means psychological factors may affect an individual profoundly, bringing about changes in chemistry, rhythm, secretion, and even structure in one or more parts of the body. In other words, bodily disturbances may be the secondaries of preceding disturbances in the integrating psycho-neuro-endocrine system, which in turn was set into a turmoil when the individual encountered events which, to him, represented deprivation, frustration, upset, strain, or difficulty.

Knowledge of Psychosomatic Disorders of Statistical Relevance

1. THE LABELS

The presence of psychosomatic illness in a community is not revealed directly in its morbidity statistics, but lies concealed under a number of labels which, with the exception of such terms as neurasthenia, nervous debility, and neurosis, have a reference to localized or mechanistic faults only. A knowledge of the considerable latent content of psychoneurotic and psychosomatic illness in certain common "diagnostic labels" has now become available as a result of recent researches. Some of these which are relevant are indicated below, but the reader is referred to the original papers for an adequate presentation of the problem.

(a) *Gastritis, Rheumatism, Anaemia, Debility, Heart Disease.*—Of 335 unselected insured patients suffering from psychoneurotic illness (mainly anxiety states) the certificated cause of incapacity in approximately one-half (170) was one or other of those labels. The proportion of psychoneurotic illness for each label was as follows: gastritis, 70 per cent.;