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Contributors

Bruce, David, Sir, 1855-1931.
Hughes, M. Louis 1867-1899.
Westcott, Sinclair.

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NOTES ON MEDITERRANEAN OR MALTA FEVER

SURGEON DAVID BRUCE

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The chief interest in the action of the nitrates centres on the powerful and long-lasting influence they exert on the circulation in man. If 5m. of ethyl nitrate be taken internally the pulse tension falls in three or four minutes, but usually not

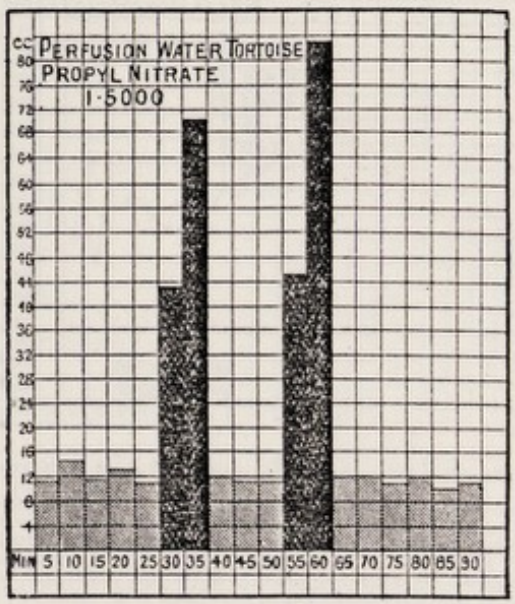


Fig. 19.—As in fig. 18, the figures at the base represent the number of minutes during which perfusion took place; those in the perpendicular line the number of c.c. passing through. The light squares show the flow when normal salt solution passed through the vessels; the dark squares when 1 in 1,000 of propyl nitrite was used.

ery considerably. It continues to fall, and reaches its owest point in thirty to sixty minutes; sometimes it is very ow for a longer time than this. The effects of ethyl nitrate on the pulse can often be distinctly seen four or five hours after a dose has been taken. (See Fig. 20A.)

As after nitrites, the pulse is somewhat quickened, but this effect is by no means marked. One minim has a distinct effect on the pulse. Propyl, isobutyl, and amyl nitrates all act in a similar manner, and as far as I have examined their action, they depress the tension for a longer time than the corresponding nitrites. Fig. 20B shows the effects of isobutyl nitrate on the man from whom the tracings after amyl nitrite and nitrate were taken.

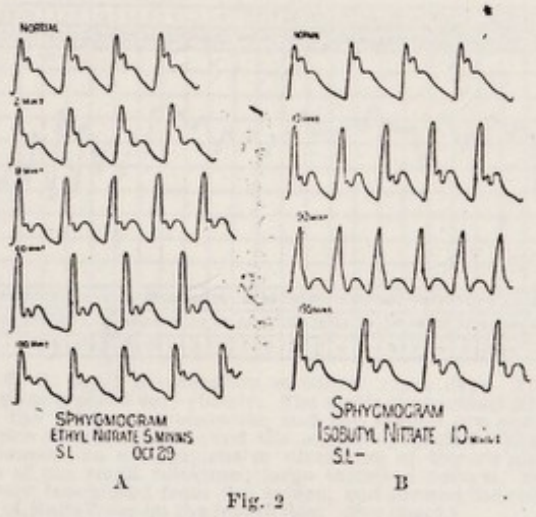


Fig. 2

The inhalation of the nitrates very slightly lowers tension. The long-lasting action of the nitrates is doubtless due to the fact that, unlike nitro-glycerine, they are somewhat difficult of decomposition. I have found the nitrate of ethyl useful in various ailments for which nitrites are usually given. There is one drawback to its use. It seems to cause a headache more often than ethyl nitrite; this headache does not always come on immediately the drug is taken; it may not appear for four or five hours. The other nitrates also tend to cause more headache than the corresponding nitrites.

NOTES ON MEDITERRANEAN OR MALTA FEVER.

I.—Its Bacteriology.

By Surgeon-Captain DAVID BRUCE, A.M.S.,
Assistant Professor of Pathology, Netley.

In this paper I do not intend to enter into the clinical features or treatment of this fever, but to confine myself to the results of the bacteriological investigation of cases of the disease, which I hope will throw some light on its etiology, and help to establish the fact that here we have to do with no local variety of typhoid or malaria, but with a definite specific disease.

The Presence of a Definite Micro-organism in Malta Fever.

To detect the presence of micro-organisms in the bodies of those suffering from a given disease, two methods may be employed—either the microscopical examination of the blood during life and the tissues after death, or the planting of small quantities of blood or particles taken from the various organs in artificial nutrient media. In Malta fever the first method is not readily applicable, as the micro-organisms are not found in the blood,[1] and being very minute, are difficult to detect in coverglass preparations, or sections of the organs. On the other hand, the method of establishing their presence by means of artificial cultivations is easily carried out. These cultivations are most successful when made from the spleen.[2]

The test tubes containing the inoculated medium should be placed in an incubator at the temperature of the blood. This necessitates the use of a nutrient medium such as agar-agar, which remains solid at this temperature; and it is most essential that the medium should be as nearly neutral as possible, since any excess of alkalinity completely inhibits growth. The following is a list of the cases in which the presence of a definite micro-organism has been established by means of such cultivation experiments.

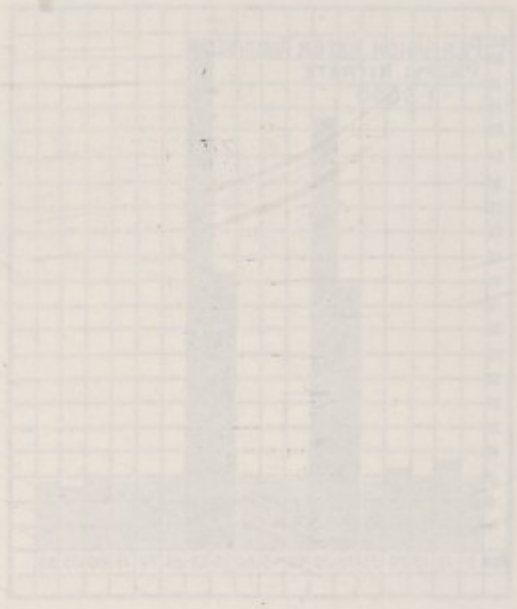
Case I.—H. D., aged 24; duration of illness twelve days. Eight tubes of agar-agar nutrient jelly were inoculated from the spleen shortly after death, and remained at the ordinary temperature of the air (about 25° C. until the following day at 11 A.M. Six of the tubes were then placed in an incubator kept at 37° C., while two were left at the ordinary temperature of the room. Minute white colonies appeared on the surface of the agar-agar in the six tubes after a period of 84 hours, and in the two others at the end of 168 hours. (See chart.)

Case II.—A. B., aged 24; duration of illness 15 days. As this case happened out of hospital I had no opportunity of making a *post-mortem* examination. I succeeded, however, in making inoculations into six tubes containing agar-agar in the following manner. Seven hours after death, having previously cleansed the skin over the region of the spleen by means of a strong solution of corrosive sublimate and absolute alcohol, I drew off a small portion of the splenic pulp by means of a sterilised trochar and cannula. Next morning five of these test tubes were placed in the incubator, and one left at the ordinary temperature of the air. No growth appeared in the tubes in the incubator until the end of 84 hours, when the same growth was observed. In the sixth tube, which had been left at the ordinary temperature, the colonies appeared at the end of 110 hours.

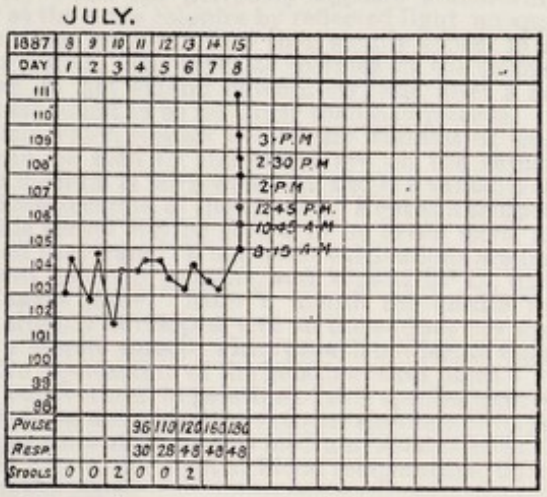
Case III.—B. E., aged 23; duration of illness eight days. Six tubes of agar-agar were inoculated from the spleen and placed in the

[1] Surgeon-Captain Hughes informs me he has succeeded in one instance in cultivating the micrococci from blood taken from the heart of a monkey dead of the disease.

[2] This organ ought to be removed from the body as soon as possible after death, protected from contamination by being wrapped in a cloth saturated with a solution of corrosive sublimate (1 in 1,000), and taken to the room set apart as a laboratory. In transferring traces of the splenic pulp to tubes containing the nutrient material, certain precautions should be taken. Three extensive cuts, the second in a plane at right angles to the first, and the third at right angles to the second and parallel to the first, are made with three knives previously thoroughly sterilised by heat. A platinum needle heated to redness before each inoculation is then used to convey a small portion of the pulp from the depth of the third cut to the solid nutrient jelly.

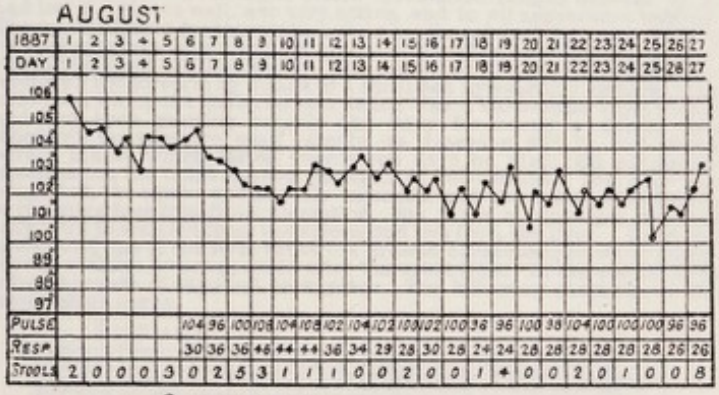


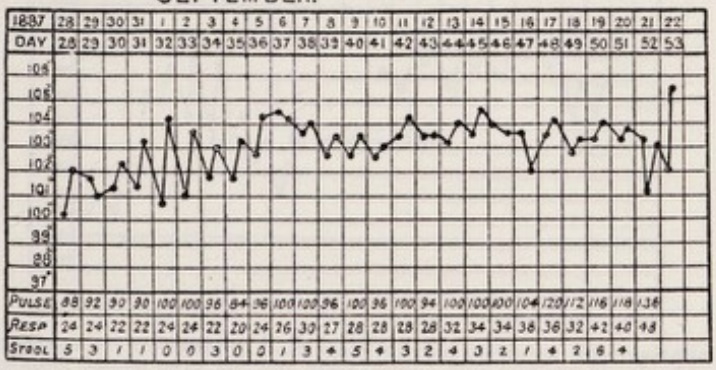
incubator. In these the characteristic growth appeared after 67 hours. The following chart illustrates the course of the disease.



CASE IV.—J. C., aged 22 years; duration of illness twenty-four days. The six tubes inoculated from the spleen showed the usual growth after the usual time. (See chart.)

CASE V.—G. W., aged 23; duration of illness fifty-three days. Inoculations were made from the liver, kidney, and spleen, but all remained perfectly sterile except one, in which the usual growth appeared after several days. I can only account for this scarcity of the micro-organisms by supposing that most of them had died out owing to the long duration of the case. The following chart illustrates the course of the disease.





CASE VI.—T. G., aged 23; duration of illness eight days. This case resembled one of typhoid very closely. The stools throughout were fluid and yellow, the abdomen tympanitic, and the tongue dry and brown. The *post-mortem* examination showed the organs congested. The spleen weighed 19 ounces; no enlargement or ulceration of Peyer's glands or other glands of the small intestine; large intestine normal. Six agar-agar tubes were inoculated from the spleen, and showed the characteristic growth of Malta fever on the fourth day. (See chart.)

CASE VII.—L. G., aged 22; died after a few days' illness. The spleen was 22 ounces in weight. Five agar-agar tubes were inoculated and placed in the incubator. The characteristic growth appeared in all the tubes on the morning of the fourth day.

CASE VIII.—C. D., aged 28; died on the eighth day of illness. Body that of a strong muscular man; mesenteric glands not enlarged; large and small intestines showed no appearance of glandular enlargement or ulceration. The spleen weighed 19 ounces, and was soft and pulpy. Six agar-agar tubes were inoculated from this organ and placed in the incubator. After four days the characteristic growth appeared in all. (See chart.)

CASE IX.—M. K., aged 21. Duration of illness thirty-four days. *Post mortem* appearances: Body much emaciated. Heart normal. Right lung adherent to the chest wall throughout; the adhesions evidently of long standing; substance of lung intensely congested, but no approach to consolidation. Left lung normal in appearance, except for some congestion at the base. Liver enlarged and congested. No trace of ulceration throughout the whole length of the alimentary tract. Mesenteric glands normal. Spleen enormously enlarged and congested; weight 25 ounces. Although this seemed to be a typical case of Malta fever, none of the inoculations made into agar-agar tubes gave any result. Afterwards it was discovered that the nutrient medium used was excessively alkaline in reaction, which accounted for the negative results.

To these nine cases may be added nine examined by Surgeon-Captain Hughes and two by Surgeon Gipps, R.N., in all of which the same micro-organism, shortly to be described, was demonstrated.

From the foregoing twenty fatal cases of this disease it will be seen that in nineteen one and the same micro-organism was found. I further made the attempt while in Malta, during the autumn of 1891, to grow this micro-organism from the tissues of the living subject by splenic puncture. Eight attempts in all were made, and of these two were successful, but the six failures were due to the use of an excessively alkaline nutrient medium in which the micro-organism would not grow.

From the foregoing considerations I think the constant occurrence in the disease of a particular micro-organism can be held as proved.

In regard to its non-occurrence in other diseases, I may mention that while in Malta I made inoculation experiments from several fatal cases of typhoid fever, and in each case cultivated a bacillus corresponding in size and manner of growth to the one described by Eberth and Gaffky. In these test tubes a copious growth appeared on the agar-agar at the end of twenty-four hours, being in marked contrast to the extremely slow growth of the micrococcus of Malta fever. In the same way dysentery, tuberculosis, pneumonia, and in fact every fatal case that occurred was made into a control experiment, but in no instance was there at any time cultivated a microbe bearing the most distant resemblance to that found in the disease under consideration.

MORPHOLOGY AND CULTURAL CHARACTERS OF THE MICROCOCCUS OF MALTA FEVER.

The Micrococcus Melitensis is round or slightly oval in form, and measures in dried preparations about 0.33μ. in diameter. It is therefore a very minute organism, and requires a magnifying power of 1,000 or 1,500 diameters. Viewed in a drop of water, unstained, the microbes are seen as bright points in active molecular movement, the great majority of them single, a few in pairs, but never in chains.[3] Like most micrococci, they possess no power of spontaneous movement. They can be readily stained in a watery solution of gentian violet, but Gram's method is not applicable, as they become decolorised in the process. Treating specimens with alcohol at once removes all colour from the micro-organisms, even after fixing them with osmic acid, corrosive sublimate, or tannic acid. In nutrient peptonised broth, kept at 37° C., no change can be seen for the first few days, but after some time the fluid becomes decidedly cloudy, without any formation of pellicle on the surface.

The best medium for the cultivation of this species is ordinary 1.5 per cent. peptonised agar-agar beef jelly. In stab cultures no change takes place for several days. Then the growth appears as minute pearly white spots scattered round the point of puncture, and minute round white colonies are also seen along the course of the needle track. After some weeks the colonies on the surface grow larger, and join to form a rosette-shaped colony, while the needle track becomes strongly marked, solid-looking and yellowish-brown in colour, with serrated edges. After the lapse of some months the growth remains restricted in area, and its colour deepens to buff.

When growing on the sloping surface of agar-agar and examined by transmitted light, the appearance of the colonies is somewhat different. At the end of nine or ten days, if kept at 37° C., some of the colonies are as large as No. 4 shot. They are round in shape, with an even contour, raised above the surface of the agar, smooth and shining. On holding up the tube and examining such colonies by

[3] Surgeon-Captain Hughes writes me that he has succeeded in growing this microbe into short chains in hanging drop cultures.

transmitted light, the centre of each is seen to be yellowish in colour, while the periphery appears bluish-white. On looking at the same colonies by reflected light no appearance of yellow can be seen; they then simply appear to be milky white in colour. The separate colonies on the surface of the agar-agar do not extend indefinitely, and after a couple of months are found to be no larger than hemp-seeds.

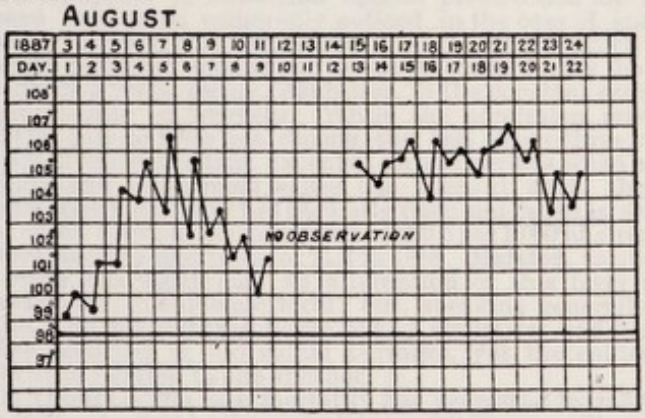
The time which elapses before the colonies of this micrococcus can be seen by the naked eye on the surface of the nutrient medium is fairly constant, and is a valuable character for the identification of the species. Kept at a temperature of 25° C. this period may be stated to be seven days, at 37° C. about half that time. When stab cultivations are made into 10 per cent. nutrient gelatine, and kept at 22° C., little or no growth takes place. After a month the needle track has become slightly developed, and on the surface can sometimes be seen a minute smooth white growth not larger than a pin's head. No liquefaction of the gelatine takes place.

Plate cultivations in gelatine of this species have not been satisfactory on account of the extreme slowness of its growth at the temperature at which this medium remains solid. Planted on boiled potato, and kept at blood temperature, no apparent growth takes place.

ON THE TRANSMISSION OF MALTA FEVER TO ANIMALS.

The effect of the subcutaneous injection of small quantities of pure cultures of the micrococcus of Malta fever were first tried on mice, guinea-pigs, and rabbits, but with altogether negative results. With monkeys, however, the results were more successful, as the following experiments will show:

EXPERIMENT I.—Monkey No. 1, male, species bonnet. The temperature of this monkey for a fortnight before inoculation ranged between 99° F. and 100° F. He ate well, was very active, and to all appearance healthy. The material used for inoculation was a portion of a colony removed from an agar-agar tube by a platinum needle, and rubbed up with a small quantity of sterilised distilled water. This was injected under the skin of the monkey's left forearm by means of a sterilised hypodermic syringe. The tube from which the material was taken was a cultivation from Case I, and had been growing outside the body for nearly a month. The monkey's temperature went rapidly up, reaching 107° F., and after a severe illness which lasted twenty-one days he died. On *post-mortem* examination the lungs showed no signs of tuberculosis; the liver was congested, the spleen enormously enlarged, and the mucous membrane of the intestines free from ulceration. Six tubes of agar-agar nutrient jelly were inoculated from the spleen and two from the liver. In all the spleen and one of the liver tubes the growth characteristic of the micrococcus of Malta fever appeared after the usual time. In the second liver tube no growth of any kind took place. The following chart shows the temperature curve.

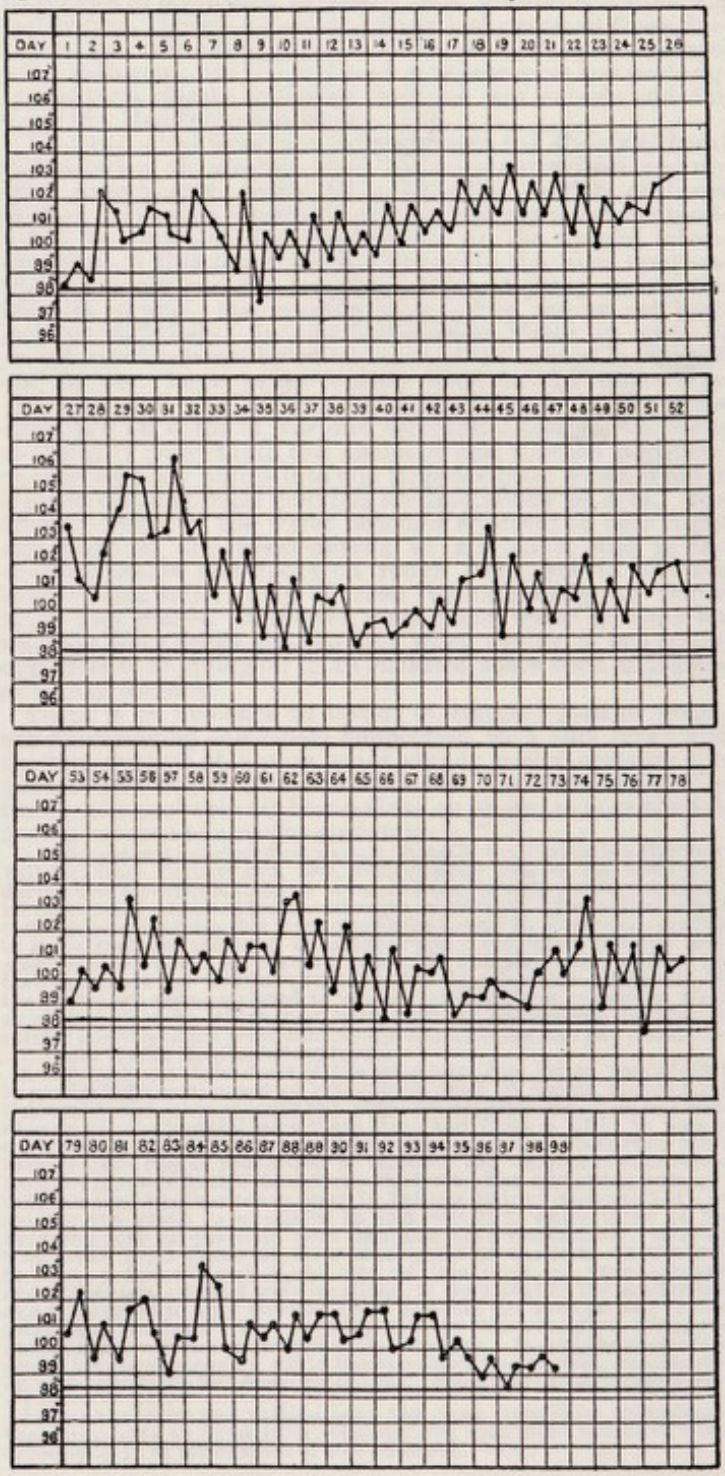


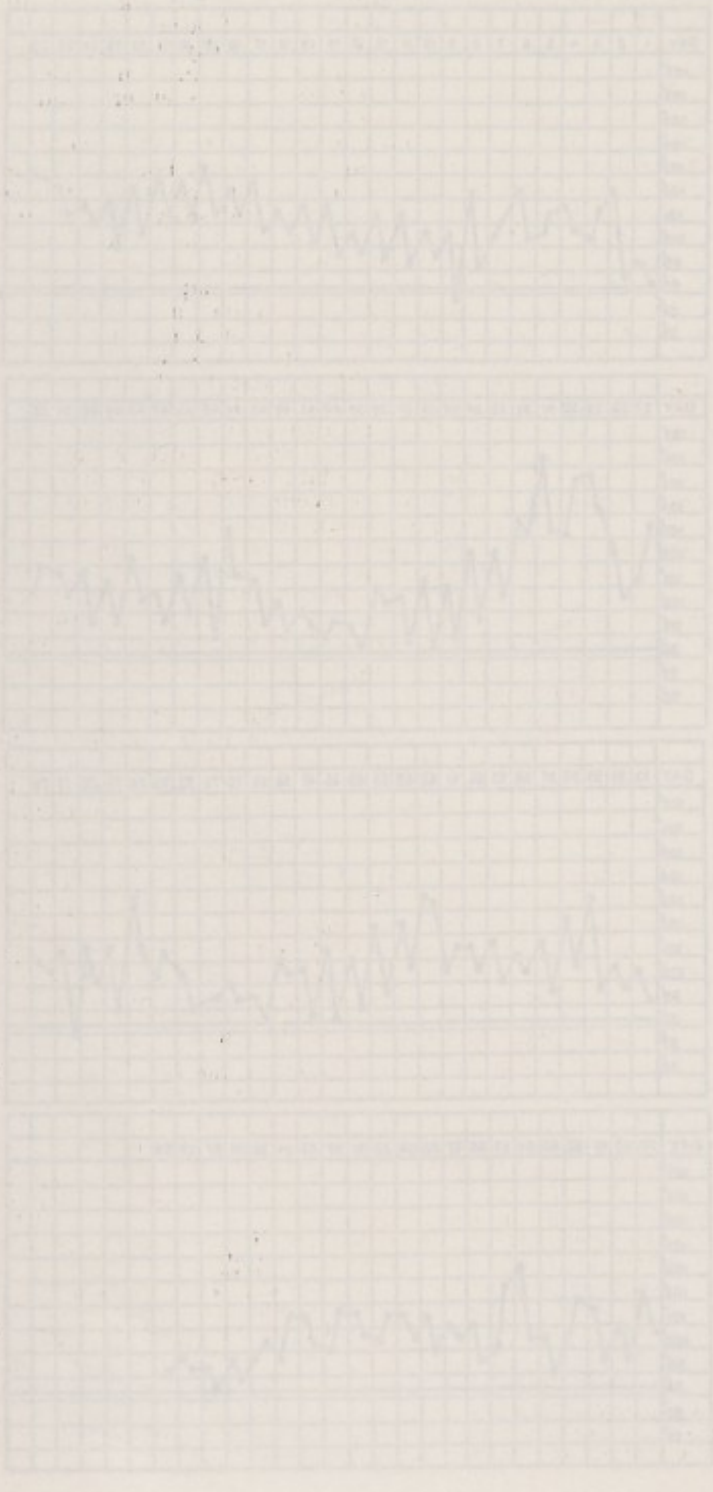
EXPERIMENT II.—Monkey No. 2, male, species unknown; inoculated in the same manner as in the last experiment. This monkey remained to all appearances in good health: his temperature, however, ran up to 104° F., at which it remained, with slight variations, for sixteen days. Some slight inflammation and pus formation occurred at the point of injection, but this passed off and the monkey recovered his usual health.

EXPERIMENT III.—Monkey No. 3, male, species bonnet. In this case the same material was used for inoculation as in the last experiment. The growth used was one from the surface of an agar-agar tube of the second generation, which had been growing for one month. This was mixed in the usual way in sterilised broth, and injected into the left arm. This monkey's temperature also ran high, and he died after thirteen days' illness. Inoculations made from the spleen into agar-agar tubes showed the first appearance of the micrococcus of Malta fever after four days.

EXPERIMENT IV.—I am indebted to Surgeon-Captain Hughes, A.M.S., for notes of the following three cases. Monkey No. 4, male, species bonnet. This monkey was under observation for two months, during which time his appetite was good and his temperature normal. He was inoculated by injecting 1 c.cm. of sterilised broth, in which had been rubbed up a small quantity of growth from an agar tube. This culture was obtained from Case X, H. H., and was 21 days old. The injection was made into the left forearm, the skin being previously shaved and thoroughly cleansed. The temperature went steadily up, reaching 106° on the fifteenth day of illness. For the first ten days the monkey was lively, and continued to eat his food, but after this time he began to lie about and refuse his food. Death occurred sixteen days after inoculation. *Post-mortem Examination.*—The body was fairly well nourished; heart, apparently normal; lungs, some sero-purulent exudation in the bronchi, otherwise the lungs appeared healthy; liver, enlarged and congested; intestines, some congestion at ileo-cæcal valve, otherwise normal; spleen, much enlarged and congested. Immediately after death the viscera were examined, and inoculations made into agar-agar from the spleen and other organs. The characteristic growth took place in the tubes inoculated after the usual time.

Experiments V and VI are interesting as exemplifying the chronic course of the fever as usually seen in man. They are also of interest from the fact that these monkeys were inoculated from pure cultures obtained from the blood and spleen of monkey, Experiment IV, and not, as in the other experiments, from the organs of man.





EXPERIMENT V.—Monkey, male, species bonnet, was under observation for three months previous to inoculation. Two days after the injection of a pure culture of the Micrococcus Melitensis obtained from the blood of Experiment IV he developed pyrexia, which lasted 2½ months, and ended in recovery. The temperature chart is very similar to that of Experiment VI, and is withheld on account of want of space.

EXPERIMENT VI.—Monkey, female, species bonnet; inoculated with a pure culture obtained from the spleen of Experiment IV. She suffered for more than three months from a very typical attack of this fever, ultimately recovering completely. The foregoing chart illustrates the chronic course of the disease, and is remarkably similar to what obtains in man.

From these experiments it will be seen that the injection of pure cultivations of the Micrococcus Melitensis into monkeys gave rise to a disease bearing a strong resemblance to that found in man, and caused death in three experiments out of six. Further, it will be noted that from the three fatal cases the same micro-organism was again recovered in a state of pure culture.

From the above considerations sufficient evidence has, in my opinion, been brought forward to show that in all probability the micrococcus above described is the proximate cause of Malta fever, and is the strongest evidence yet adduced to show that this disease is a specific fever, quite distinct from typhoid or malaria.

In regard to the important question as to how this micro-organism gains access to the human subject, whether by the air, in the drinking water, or in the food, absolutely nothing is known up to the present, and on account of the high temperature required for its growth, the length of time which elapses before the colonies appear, and the absence of any well-marked morphological or cultural characteristics, the search for it outside the body will be found very difficult.

II.—ITS BEHAVIOUR AT MALTA.*

BY SURGEON-CAPTAIN M. LOUIS HUGHES, A.M.S.,
Malta.
(In charge of Military Analytical Laboratory, Valletta.)

"MEDITERRANEAN, Malta, or rock fever," officially returned in the army statistics as "simple continued fever," presents far larger admission and invaliding rates in certain Mediterranean garrison towns than any other disease.

I. *Quantity.*—The Maltese suffer proportionally less from it than British troops, but it is said to be increasing in frequency among the civil population of Valletta. It does not, however, appear to show that special predilection for newcomers that is so commonly noticed in the case of enteric fever. In quantity it has, however, on the whole, slowly but steadily decreased among the troops in Malta during the last seventy-five years, owing, doubtless, to the constant sanitary improvements in barracks. While the admission rate per 1,000 for enteric fever has during the last thirty-three years remained fairly constant, except at certain periods when some definite and widespread cause has been at work, that of simple continued fever has regularly risen and fallen in seven-year cycles between the maximum of 269.5 per 1,000 of strength in 1859, and the minimum of 71.2 in 1888. Marston, as quoted by Bruce, has mentioned an alternation of this fever with enteric fever, in epidemic form; but, speaking generally for Malta, I do not find this borne out by statistics; and though it has occurred in individual barracks, yet the epidemics have little relation to one another.

II. *Quality.*—The case mortality has decreased from 3.08 in the sixties to 2.60 in the seventies, and 0.93 per mille in the eighties. Epidemics of note have become rare since 1873, and rapidly fatal cases are in the present day few. The admission and mortality rates during each seven-year cycle have risen together to a maximum, but the death-rate has fallen earlier and faster than the admission-rate. Finally, the admission-rate for rheumatic affections (in most instances the characteristic sequelæ of Mediterranean fever) has, as far as quantity is concerned, shown the same variations and general decrease as the fever in question.

III. *Seasonal Prevalence.*—Though ague (that is intermittent fever) does not exist as an endemic disease in Malta yet the seasonal prevalence of Mediterranean fever exactly corresponds to that of the so-called malarial poison. Becoming fairly prevalent in April the attack-rate reaches a maximum in July, August, and September, the hottest and driest months, and then falls until, in the wet and cold months of December, January, and February, a few sporadic though often extremely fatal cases occur. Enteric fever, on the other hand, becomes most prevalent after the first heavy rains, continuing during the autumn and early winter months.

IV. *Localisation.*—It has always been distinctly endemic in (1) the barracks, houses and hovels built by the Knights between the beginning of the sixteenth and end of the eighteenth centuries—all these buildings have for years been in an overcrowded and insanitary condition though at present subject to yearly improvements; (2) in the ships at anchor in the harbours of Malta.

The fever is certainly not contagious from man to man, and both in localisation and general clinical characters it has a close analogy to enteric fever. In one instance lately three fatal cases of fever were admitted from a barrack containing eighty men, though no cases of fever had occurred there during the preceding twelve months. Clinically they were somewhat analogous, but the *post-mortem* appearances and bacteriological tests clearly indicated that one was enteric and the other two Mediterranean fever.

Bacteriological facts in no way negative the theory of fæcal transmission of infection, and hygienic authorities and my own experiments point to a suitable reaction of fæces sewage, and more especially of rock and sea water contaminated by sewage, for the growth of the special micro-organism of this fever, though owing to the high temperature necessary and the length of time elapsing before the colonies appear, the specific growth has not as yet been isolated definitely. In the harbours of Malta, in spite of recent improvements by which most of the sewage is pumped out to sea, large sewer outlets exist in the Quarantine Harbour, and the excreta of some 5,000 to 8,000 sailors employed on ships of war and mercantile vessels, are being continually poured into the enclosed and tideless harbours, converting their basins into one large cesspool, which is never cleaned out, and must hold the accumulations of ages. The offensive state of the water becomes apparent to both sight and smell at the sewer-outlets at all times, and in the enclosed creeks and docks on rough days, yet in summer soldiers and sailors may be seen bathing daily all round these very places. Moreover, this same water is used for washing down decks, etc., so that when drying it has ample opportunity of giving off in an enclosed space such miasmata as it may contain.

There is no evidence in favour of infected food or drinking water having any causal connection with this fever, and the introduction of a pure water supply under pressure has not lessened its prevalence in Valletta. The facts point distinctly to a probable air-borne virus on shore, as does the following account of a recent epidemic:

A regiment was quartered on a small island in the Quarantine Harbour, Valletta, from January 2nd, 1892, until October 10th of the same year, during which period it suffered severely from "simple continued fever," 197 cases being admitted from a strength of 760 men. The regiment had suffered severely from this fever elsewhere during its first year's service in Malta, had been seasoned by a three years' residence, and was composed of men whose ages were not below the average of the station, yet their fever rate for 1892 far exceeded that of any other regiment. Of these men, 480 were quartered in wooden huts, and the remaining 280 in an old fort close by, which had been built by the Knights in 1725. A careful analysis of the fever admissions divides them into two classes:—

1. Cases of true Mediterranean fever.
2. Relapses and slight cases of the same fever (the latter possibly due to special individual power of resistance), cases of simple ardent fever (febricula), and other obscure but slight febrile ailments. The last class of cases were in hospital but a short time, and there is little to note of consequence except that the numbers were higher than those from other barracks, and that in proportion to strength the number of admissions from the fort was double that from the huts. The admission rate per mille for true Mediterranean fever in Valletta district (strength 3,511, including the island in question) in 1892 was 52.2, while those of the huts and fort in question were 46.3 and 178.6 respectively, showing that some local cause of fever must exist in the fort. In the fort, 38 men, 2 women, and 5 children of this regiment were affected, and of the men, 1 died, 6 were invalided, 14 were sent to the sanitarium, and 17 returned to duty straight from hospital, the average stay in hospital being 99.3 days.[3] The majority of these rooms are dark, close, and damp, and were never intended for barracks. Round the back of the rooms ran large channels, cut in the extremely porous rock, and passing on each side of the fort down to the sea. From 1870 these channels were

* Abstract of a paper read to the Malta Branch of the British Medical Association.

[3] Since the above was written news has come from Gozo that some of these men have suffered from relapses, and even been invalided home, accentuating the seriousness of this outbreak.

used as sewers, until the substitution in 1885 of the present dry-earth system. Mediterranean fever occurred in the fort during this period, being epidemic in 1870 and 1872, but not excessive in 1885-91. From 1885 to 1891 a quantity of sewage remained boxed up, with the result that the stone became soaked with sewage, even through the walls and flooring to the adjacent rooms. Recent analysis of portions of the walls of the channels and rooms showed not only a larger percentage of chemical constituents of sewage with the presence of much organic matter and large numbers of putrid and non-pathogenic organisms, but also a neutral or faintly alkaline reaction as compared with clean newly-quarried and similar stone, which is highly alkaline, thereby forming theoretically a suitable nidus for the minute micrococcus of this fever. Between September and December, 1891, a thorough overhauling of the drains took place, these channels being cleaned and converted into surface-water drains, gratings being placed at intervals almost on a level with, and adjacent to, or even opposite, the windows of the barrack rooms. Owing to their situation and construction there was a varying yet constant current of air from the sea travelling up these channels and passing out of the gratings into the fort, the porous walls at the same time being wet or dry according to the state of the atmosphere and the amount of rain. There was ample opportunity for miasmata to pass from the rock channels into the barrack rooms, and it is a sufficient fact that these 45 cases slept in beds grouped in close and definite relation to the rock-channel gratings and sewage-soaked walls, and were in direct proportion to the dampness present. The first case was admitted on February 4th, four days after the cessation of the heavy rain. There was no other apparent cause for the outbreak; obvious sanitary improvements resulted in a cessation of the fever, and it has not broken out again this spring.

The drainage of Valletta would seem to have some relationship to the reported increase of this fever among the civil population. The drains originally consisted of very large, deep channels, cut by the Knights in the porous rock, with faulty gradients and no flushing. In these the sewage was semistagnant, keeping a fairly average level during the dry months, at the same time soaking for years into the porous walls. Between 1879 and 1885 new sewer pipes of a suitable size, and well ventilated, were accurately laid at the bottom of these channels, the upper part being used as a surface and storm water drain. This upper part is wet in the rainy season, but dry and suitable during the hot months for the escape of miasmata, which by the way of the ventilators and numerous traps (also at this time dry) must pass into the houses. At the same time, on account of the hilly nature of the ground on which Valletta is built, many even of the more modern ventilators, though carried high above the roof, are yet on a level with the windows of houses across the street. Whether from insufficient flushing or other causes, their smell is often offensively perceptible in summer, and the writer has frequently come across cases of Mediterranean fever occurring in persons sleeping in rooms near such ventilators. This increased prevalence therefore may be due to an increase in the mechanical means of diffusion of the virus. Again in Gibraltar, where the rock is less porous and less absorbent than in Malta, this fever is less prevalent and milder in type.

If the foregoing facts have led us to correct conclusions, there is every chance of our being able in the future to lessen the prevalence of this fever. If we have acted in ignorance of its nature in the past, let us improve in the future, by careful attention to sanitation, by regulated bathing places, by providing suitable air space and ventilation for the diffusion of the poison in old and dangerous barracks, and while cutting off and avoiding old sources of infection, prevent fresh pollution of the rock, harbours, and air dwellings; the last by improving the height and situation of drain ventilators, and possibly by the introduction of modern sewer-gas destructors.

In conclusion, I would point out that this fever, allied as it is to enteric fever, yet belongs distinctly to the mobile group, characterised by an uncertain duration, a tendency to relapses, and a feeble power of conferring immunity from subsequent attacks, and is a link between enteric fever and the so-called malarial marsh fever (intermittent ague).

III.—Certain Complications.

By Surgeon-Captain SINCLAIR WESTCOTT, A.M.S.

Ordinary Course of the Fever.—The onset may be insidious or sudden, with fever of remittent type, simulating that of enteric fever; but the temperature soon becomes irregular, and, generally towards the end of the second week, the concomitant constitutional symptoms commence to disappear, the tongue cleans, the appetite returns, the mental condition improves, and we hope that convalescence has commenced; but the temperature remains high, and at any moment the patient is liable to suffer from a complication resembling rheumatic fever; the joints swell and become painful, and the constitutional symptoms of fever return, but the characteristic perspiration of rheumatic fever is absent, and there is evidently no relation to it. This complication, like every symptom of this disease, is of most uncertain duration and degree; it may attack only one or two joints and last only a day or two, or it may cause permanent joint disease.

Local Paralysis and Atrophy of Muscles.—Local paralysis occurs frequently. The extensor muscles of the feet are those almost exclusively affected; the extensor proprius pollicis is more completely paralysed than the others, and the big toe drops in a most characteristic manner. I have seen two cases in which the muscles of the shoulder and arm were affected, but they were exceptional. This symptom is a late manifestation, seldom appearing within four months, but in one case it occurred as early as the end of the second week of the disease. The paralysed muscles atrophy slowly, and recover their proportions long after power has returned to them. The alterations in the electrical reactions are both quantitative and qualitative. Diminution of the muscular response is the only quantitative alteration I have noticed. The qualitative alterations are both modal and serial; the former consists in a sluggish contraction with marked duration of tetanus; in some cases this is the only change, but in those of long duration there is an overtaking of the cathodal closing contraction by the anodal closing contraction. Recovery is generally complete, but it takes place slowly.

Rheumatoid Pains: Neuralgia.—Rheumatic pains, especially in the back and lower extremities, and neuralgia, particularly of the sciatic nerve, accompany the disease, and are symptoms which persist during the long convalescence.

Anæmia.—Anæmia is always present, and it does not seem to be influenced by the administration of iron.

A CASE OF TYPHOID FEVER FOLLOWED BY PERFORATION AND RECOVERY.

By ANTHONY McCALL, M.B., C.M.,
Conisborough.

Mrs. W., aged 34, a thin, "wiry" woman, complained of general *malaise*, headache, muscular tremors, etc., on August 25th, 1892. As she had been nursing her son who was recovering from an attack of typhoid fever she was at once ordered to bed, and a calomel and rhubarb powder given with the usual typhoid dietary, and salol in 5-grain doses every three hours. The fever pursued a typical but mild course until the fifth day, when the temperature reached 104.4°. On inquiry it was found that the salol powders had not been given since the previous evening. 10-grain doses every two hours were then ordered, and by evening the temperature was 102°. The rash appeared on the eighth day.

On the morning of the fifteenth day of the fever the patient's temperature was 101.6°, and she was not visited again that day as her progress was so satisfactory.

Early on the morning of September 10th (the sixteenth day) she was visited in answer to an urgent call, and found in a state of collapse. She was propped up in bed, breathing hurriedly, evidently in great pain, vomiting every few minutes; beads of perspiration stood out on the forehead; the features were pinched and dusky, and she presented all the symptoms of impending death. Her temperature was 97°, the extremities cold; there was marked tympanites, and great tenderness over the cæcum. The collapse was treated by repeated small doses of stimulants, the extremities packed round with hot bricks wrapped in flannel, and a mixture containing tinct. opii ♏20, spt. ammon. aromat. ♏15 given every hour. She took fluid nourishment in small quantities and gradually improved. The temperature was 98.6° at 8 P.M.

On September 11th vomiting was still troublesome; there was a considerable area of dulness over the cæcum, and slight dulness in both flanks. The circumference of the abdomen at the umbilicus was 35 inches, 7 inches more than normal. A 2-pint enema of hot water was used, and the bowels acted well.