cream. The membrane remained intact for eight days, when it separated. The lower part of the arm had healed; all the rest of the original burnt areas were covered by brownish sloughs, which separated 11 days later, leaving granulating surfaces, which it was decided to graft.

Case 8.—Female aged 27, seen as an out-patient 24 hours after scalding leg with boiling water. After cleaning, a membrane was applied, with almost immediately relief of pain. The membrane dried up, but two days later a small area in the centre became digested. Healing proceeded rapidly under the intact parts of the membrane, and was complete in 12 days.

Experimental Burns

Burns were produced on the upper part of the extensor surface of the forearms by the application of the end of a copper cylinder, 1 in. in diameter, through which hot water was flowing. The apparatus was devised by Prof. R. A. Peters (Leach, Peters, and Rossiter, 1943). The results are set out in tabular form below:

Subject I (R. G. M.)

Time	Left Arm	Right Arm
0	56° C. applied for 45 seconds Blistering and detachment of cuticle over whole area. Covered by fibrin membrane and left exposed to air. Immediate relief of pain.	56° C. for 50 seconds Blistering and detachment of cuticle over whole area. Covered by fibrin membrane, then by oiled silk to keep moist. Pain relieved.
30 mins.	Membrane has dried into hard transparent film where attached to skin; soft and pliable over burnt area. No pain.	Membrane unfortunately torn off when boarding a moving tram. Area oedematous and inflamed. Dressed with castor oil and sulphanilamide.
3 hours	Membrane dry and firmly attached. No oedema. No other covering. No pain or discomfort.	Painful and tender. Discharging pus. Redness over area 3 in. in diameter. Oedema over area 4 in. in diameter.
24 hours	Membrane covered with dry gauze and strapping to prevent accidental detachment. Perfectly comfortable and painless.	Re-dressed, with relief of pain. Painful and swollen. Culture: <i>Staph. aureus</i> .
48 hours	Apparently healed under membrane, which is now quite dry.	Oedema of whole forearm. Dressed with penicillin.
4 days	Membrane flaking off, leaving new epithelium. Completely healed.	Better, but still swollen and painful. Re-dressed.
6 days	—	As before.
8 days	—	Better; beginning to dry up.
10 days	—	Scab formation.
12 days	—	Scab flaking off, leaving new epithelium.
3 weeks	—	Healed.
4 weeks	—	Obvious scar.
9 months	No scar.	

Subject II (L. C.)

Time	Left Arm	Right Arm
0	56° C. for 60 seconds Detachment of cuticle. Dressed with sulphanilamide cream under oiled paper. Relief of pain.	56° C. for 60 seconds Detachment of cuticle. Dressed with fibrin membrane. Relief of pain.
40 mins.	No pain or swelling. Re-dressed as before.	No pain or swelling. Some leakage of fluid beneath loose corner of membrane.
24 hours	No pain, no swelling. Re-dressed as before.	No pain or swelling.
48 hours	Some inflammation and oedema round burn, which is covered by a film of yellow exudate. Allowed to dry in air.	Membrane dry and firm. No inflammation or oedema.
4 days	Dry and comfortable.	Some oedema and discomfort. Infected with <i>Staph. aureus</i> and diphtheroids. Fibrin membrane digested. Dressed with penicillin.
6 days		Hard scab.
9 days	Hard scab.	Healed.
11 days	Healed.	
12 days		

Conclusions

It is clear that the covering of burnt areas with an adhesive membrane of human fibrin is a comparatively easy procedure. From the results, however, it will be seen that any clinical advantage over orthodox treatment is so slight as to make the trouble involved in preparation and application hardly worth while. The membranes relieve pain rapidly and form comfortable dressings, but the same can be said equally of many other applications. They may, to a certain extent, reduce fluid loss during the first 24 hours, but it would probably be more economical to transfuse the patient with the plasma required to make the membrane. In the cases that became infected the membranes were rapidly lysed. In favourable cases

the membrane dried into a scab, and healing proceeded beneath this. Even so, however, healing did not appear to be much more rapid than was the case in other areas treated differently.*

The problem of the fluid loss from burnt areas still remains, and its causation is of obvious interest and importance. That it is due mainly to paralysis or disordered function of the capillaries seems probable. Attempts to restore this capillary function might be therapeutically profitable.

I wish to thank particularly Dr. L. Colebrook for his kindness and advice in Glasgow, Prof. J. W. S. Blacklock for providing laboratory accommodation, and Dr. J. M. Barnes for allowing me to apply this form of treatment to his cases in Oxford. I am also indebted to Prof. R. A. Peters for advice and interest. My gratitude is due to the Medical Research Council for financial assistance and to Glaxo Laboratories Ltd. for the gift of special apparatus that was used in the experiments on blood coagulation and the preparation of fibrin, thrombin, and fibrinogen.

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OUTBREAK OF SANDFLY FEVER IN TWO GENERAL HOSPITALS IN THE MIDDLE EAST

BY

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From July 28 to the end of Oct., 1942, there was a severe and explosive outbreak of sandfly fever among the staffs of two general hospitals and among the patients admitted to one of them. These two hospitals came to a new station during the last week of July. They occupied newly made sites, side by side. Hospital A took over the site and patients of another hospital which had been working since early June, 1942. Hospital B did not receive patients until the beginning of September.

Within a few days of arrival members of the staff of both units began to get sandfly fever, other ranks being more affected than officers and sisters. Later, patients who had been admitted to Hospital A for other complaints contracted the disease. By the end of August the epidemic had become serious. It ceased abruptly at the end of October.

Incidence of Sandfly Fever among Unit Personnel

Several of the "other ranks" had two or more attacks, which explains why the total number of admissions exceeded the

* Since submitting this report I have learned through the Medical Research Council that Ingraham and Perring of Harvard Medical School are using fibrin membranes "plasticized" by glycerol to prevent them becoming brittle, and sometimes backed with cotton. These improved membranes have given good results as a dressing for burns, and particularly as a dural substitute in brain surgery. Fibrin has also been used as a haemostatic. I have used small pieces of fibrin membrane soaked in thrombin as a haemostatic dressing for haemophilic cases with very encouraging results.

total strength. Even so, the majority of N.C.O.s and men suffered from the disease.

Hospital A

	Total Admissions, including Readmissions	Average Total Strength
Officers	8	30
Sisters	20	80
Other ranks	282	240

Chart 1 shows the number of other ranks admitted each day and the number remaining in hospital. It will be seen that for fifteen consecutive days from Aug. 27 to Sept. 10 there were over 70 men in hospital. The peak was reached on Sept. 2

(87 men). The epidemic occurred at a time when the hospital was busy. In all, 1,910 patients had been admitted to the medical division alone between July 29 and Sept. 30.

Hospital B

	Total Admissions, including Readmissions	Average Total Strength
Officers	12	28
Sisters	12	30 to 80
Other ranks	171	210

Chart 2 shows the figures for Hospital B. The epidemic was less severe than at Hospital A, but was nevertheless serious. The peak was reached on Aug. 26, when there were 50 men in hospital. In addition to the 171 cases admitted to hospital at least 30 more N.C.O.s and men were treated in their tents. The unit was not working to capacity, since patients were not received until the beginning of September.

Incidence of Sandfly Fever among Patients admitted to Hospital A for Other Diseases

At Hospital A 365 patients who had been admitted for other diseases developed sandfly fever. Chart 3 shows the daily incidence of the disease and also the total number of patients in hospital. It will be seen that there were two periods when

the total number of patients in hospital was greatest—that is, shortly after the admission of fresh convoys of patients.

The distribution of the disease in the wards of Hospital A is interesting (see Chart 4). With the exception of wards 2, 10, 11, and 12, which were not in use until October, all wards contained approximately the same number of patients throughout the period of the epidemic. The incidence of sandfly fever was greatest in surgical wards 1 and 6, and lowest in medical wards 3 and 4. Ward 1 was a stone ward, whereas ward 6 was a group of tents. Hence it appears that the incidence did not depend on whether the wards were "hatted" or "tentted." It will be seen from Chart 4 that the situation of the ward was important. The camp was newly constructed

and, although it was largely tentted and widely dispersed, there were some huts built of stone and the ground was stony. Much stone and rubble lay around and near the buildings. Where this was greatest—around wards 1 and 6 and also around wards 7, 8, and 9—the incidence of the disease was high. Where this was least—around wards 3 and 4 and particularly 13 and 14—it was low. This accords with the known habitat and short flight of the phlebotomus.

Clinical

The clinical picture was classical. One of us (E. R. C.) has seen many outbreaks of "short-term fevers," but none in which the symptoms and signs agreed so exactly with the standard

descriptions of sandfly fever. The incubation period in most instances was unknown, but in a few there was reasonable evidence that it was as short as 3 days. Cases occurred exactly 3 days after men had arrived from another country.

The onset was usually abrupt, with severe headache—particularly supra-orbital headache—pain in the back, and fever. There was pain behind the eyes, and especially on movement of the eyes. Sometimes there was pain in the thighs and along the line of the ribs, or dysuria. When the patient reported sick the temperature was usually raised

was pain in the thighs and along the line of the ribs, or dysuria. When the patient reported sick the temperature was usually raised

to 102° or 103°, but occasionally the initial symptoms preceded the fever by 14 hours. Conjunctival congestion and pain on pressing the eyeballs were a common finding. The fever lasted from 1 to 8 days, but in most cases from 3 to 4 days. In about 10% there was a short secondary rise of temperature, usually about the 6th or 7th day. The initial temperature was sometimes over 105°, and the prostration was great. Many of the patients appeared very ill, and in a few instances the photophobia was agonizing. Drowsiness was sometimes pronounced, and in one patient the cerebrospinal fluid contained 110 lymphocytes per c.mm. and 90 mg. of protein per 100 c.cm. The colloidal gold test was negative. The disease was often followed by debility and depression. There were no complications and no deaths. Members of the hospital staff were usually off duty for 7 to 12 days and sometimes longer. Several senior N.C.O.s who had never been in hospital before were affected. Some of the patients who had previously suffered from malaria remarked that sandfly fever "knocked them out" far more than malaria.

The classical clinical picture and the known heavy infestation of the camp with the phlebotomus left the diagnosis in little doubt. The *Aedes aegypti* had not been seen, and dengue could be excluded. Neither malarial parasites nor spirochaetes were seen among the many hundreds of blood slides examined.

Immunity

It is sometimes said that one attack of sandfly fever confers a sound and lasting immunity. This is not our experience. It is true that both hospitals were newcomers to the district. Hospital B had recently arrived from England, and although Hospital A had been in the Middle East for a considerable time, it had been in a district where the disease was unknown among the staff. In the present epidemic 15% of the N.C.O.s and men had two attacks, and some had three attacks, during the three-months period, at intervals ranging from two weeks to three months. The initial symptoms of the later attacks were often as severe as those of the first attack, but the illness tended to be shorter. Between the attacks the men were on duty and felt fit. The attacks ceased abruptly at the end of October. It seems clear that second attacks were not relapses but fresh infections. It is possible that men succumbed to a fresh infection before immunity had developed or that a second attack was caused by a different strain of infection. It appears, however, that one attack conferred little or no immunity in this area.

Control

Antimalarial precautions were strictly observed by the personnel of both units. At Hospital B from September onwards all tents were "flitted" in the evening and half an hour before reveille. Men were ordered to be properly clothed until the sun was well up. These measures had little effect on the incidence of the disease.

At Hospital A an attempt was made to stem the tide of the epidemic among patients in hospital for other diseases. It was obviously impossible to deal with the breeding-grounds of the phlebotomus. This would have entailed concreting or asphaltting the whole site. Acting on the assumption that the phlebotomus starts biting at about 9 p.m. and continues until the sun is well up, the following measures were adopted early in September and rigorously enforced:

Every patient suffering from or suspected to be suffering from phlebotomus fever was nursed under a sandfly net day and night until he was afebrile. All other patients had their nets lowered from one hour before sunset until the wards had been "flitted" the following morning. Every ward and annexe (including latrines) was "flitted" three times a day—just before wakening the patients, before the evening lowering of the nets, and at "lights out."

A glance at Chart 3 suggests that these measures had little or no effect on the incidence of the disease.

A suggestion was made that the infection might be controlled in the wards by burning pyrethrum powder throughout the night. The epidemic ceased, however, when this suggestion was made.

If there should be another epidemic in the future, it is proposed to carry out a controlled experiment, using the burning powder in two out of four tents in each group of tented wards.

SANDFLY FEVER AND THE RHEUMATIC SERIES

BY

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The similarity between sandfly fever and influenza is generally known, though I have not heard of this fever being associated with the rheumatic series. Towards the end of the Sicilian campaign I had two cases of sandfly fever, and one case which, for want of a better diagnosis, I have named "pyrexia of rheumatic origin"; all three cases bore a remarkable similarity—so much so that I consider them worthy of record.

Case Histories

Case 1.—Diagnosis, sandfly fever. This patient, a leading stoker aged 22, went ashore in Sicily on the evening of Aug. 5, 1943, for recreational leave. On the evening of the 9th he reported to the sick bay, stating that he felt as if he had influenza. His temperature was 102° and his pulse rate 96. He complained of general stiffness of his limbs, intense pain behind the eyes, slight epigastric discomfort, and pain in his abdomen which radiated to the loins. He vomited twice during the evening, before reporting. On examination he was flushed, his conjunctivae were injected, and his tongue was furred. He was suffering from numerous insect-bites on his legs and trunk. His temperature slowly resolved, as is shown on the chart, and his symptoms abated with the diminution of fever. He was given 10 minims of tinct. opii three times a day, and tinct. iodi mitis to the insect-bites; he was also given A.P.C. tablets for the headache.

FIG. 1.—Temperature Chart of Case 1.

Case 2.—Diagnosis, sandfly fever. A leading stoker aged 24 went ashore in Sicily on the evening of Aug. 5, 1943. On the morning of the 11th he reported to the sick bay, complaining of intense supra-orbital headache and stiffness at the back of the neck and on the shoulders. He said that he had been feeling "off colour" for 24 hours previously. He complained of general lassitude and tiredness, but otherwise felt all right. His temperature was 101° and pulse 80. Towards the evening he sweated profusely, his face became swollen, and he suffered from severe conjunctivitis. He found difficulty in resting quiet in bed because of generalized aches and pains. There were a few isolated insect-bites on his trunk and legs, and he suffered from nausea and could not take his food. On the 13th the conjunctivitis cleared, but the headache persisted until the 18th. The generalized aches and pains in his limbs settled on the evening of the 15th, and from then on he appeared to be much better. He began taking his food normally, and finally was allowed up on the evening of Aug. 19, after eight days' sickness. He was treated with tinct. opii 10 minims b.d., aspirin and phenacetin aa gr. 5 S.O.S., luminal gr. 2, to help his insomnia.

FIG. 2.—Temperature Chart of Case 2.

Case 3.—A leading seaman aged 20 reported to the sick bay on the evening of Aug. 11, 1943, stating that he was suffering from an influenzal attack; he had not been ashore for some time. He said that he had been feeling ill all day, but thought that he would