experience of alopecia areata it has not been difficult, in both children and adults, to demonstrate a preceding emotional stress. Auricular fibrillation is associated with mitral stenosis, with thyrotoxicosis, and with myocardial degeneration. None of these conditions was present in our patient. Distinct from these varieties is another group called "paroxysmal auricular fibrillation." It is characteristic of these paroxysms that they last only a few hours or days, that they recur frequently, and that they are corrected to a normal rhythm with ease and safety by quinidine therapy. It is difficult to define as paroxysmal a condition which has persisted for eighteen months, as in our patient. When auricular fibrillation is unassociated with any organic disease and when it is preceded by adequate emotional tension, as in this man, it is reasonable to name it a cardiac neurosis.

This man's illness illustrates the varied factors—genetic, constitutional, psychological, environmental, and mechanistic—which we seek to assess in an evaluation of disease in man, but it also indicates how remote is the day of full comprehension. The link between the emotion which fails to find its appropriate physical discharge and the consequent physical disorder is usually assumed to be the vegetative nervous system; while this path is probable, the endocrine system offers an alternative mechanism. Both alopecia and auricular fibrillation are sometimes associated with endocrine disorder. We are far from a coherent conception of the mechanism by which emotional stress is translated into physical disorder. Not to seek this link, however, or, worse, to ignore its existence, is a heretical denial of the integrity of mind and body.

The present controversy between those who support the "biological" approach to aetiology ("What sort of man is this, and why did he become ill in the way he did?") and those who are preoccupied with mechanism ("What has the patient got?") implies a schism in diagnosis and therapy which is quite unreal. In our patient it was possible to define closely but one of the faulty mechanisms involved (i.e., auricular fibrillation), and here it was easy to intervene to the man's great advantage. While the biological approach to aetiology had in this case none of this immediate practical quality, yet it contributed to a fuller understanding of the sufferer and his disorder. The physician cannot disdain any approach which increases either his understanding or his capacity to help his patient.

We are grateful to Dr. J. T. Ingram, dermatologist to the General Infirmary at Leeds, for his expert help and criticism in the preparation of this paper, and to Dr. G. R. Osborn, pathologist to the Derbyshire Royal Infirmary, for the photograph and the report on the sections of the tumour.

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A MILK-BORNE OUTBREAK OF GASTRO-ENTERITIS DUE TO SALMONELLA DUBLIN

BY

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On Aug. 19, 1943, the County Medical Officer of the West Riding of Yorkshire was informed that the practitioners in Knaresborough Urban District had throughout that day been called in to attend to numerous cases of sickness and diarrhoea. Inquiry by the local medical officer of health showed that all the cases had occurred in households supplied with milk from Farm G, situated at a village about two miles distant in an adjoining rural district. Simultaneously cases had occurred among residents at the farm. It therefore seemed that the disease was conveyed by the milk distributed from Farm G. Subsequent investigation proved that the outbreak was caused by *Salmonella dublin*, that the vehicle of infection was milk from Farm G, and that the source of infection was an apparently healthy cow which was a carrier of the organism.

Symptoms

The onset of the disease was sudden, with sickness or actual vomiting, diarrhoea, headache, and fever ranging from 100° to 102° F. The diarrhoea was profuse, but there was no blood or mucus in the motions. The febrile period lasted for about three days at the longest. A profuse herpetic eruption on the lips and nose was noted in a small proportion of cases. One patient complained of persistent headache for some days during convalescence. Many cases were very mild, and some patients were not confined to bed or were confined to bed only for a day. There were no deaths.

On Aug. 29 a baby 2 months old died of meningitis, but unfortunately no bacteriological or post-mortem examination was made. This child, which was breast-fed, did not suffer from diarrhoea. It was a member of a household of five persons supplied with milk from Farm G. One member of the household (not the mother) had been ill with diarrhoea about Aug. 19. This case is noted because Smith (1934) has described two sporadic cases of meningitis in children due to *S. dublin*.

Incubation Period

Cases occurred among the residents at a hostel for evacuee children, from particulars of which the duration of the incubation period was determined. The circumstances also confirmed the fact that the outbreak was milk-borne. At the hostel there were 7 children and a staff consisting of a matron, a nurse, and a cook. A daily charwoman was also employed. At the time of the outbreak a friend of the nurse was staying there. The hostel was supplied with milk from Farm G, and the residents, with the exception of the matron, and cook, had milk at about 11 a.m. on Aug. 18. The charwoman also had milk on that day. About 2 a.m. on the 19th three of the children complained of sickness and diarrhoea, and by 8 a.m. all the children, the nurse, and her friend were ill. The charwoman, on arriving at the hostel that morning, complained that she had suffered from sickness and diarrhoea during the night. The matron and cook, who did not take milk, remained well.

The interval of time between the consumption of milk and the onset of symptoms varied from 14 to 20 hours. This relatively long incubation period suggested infection with living *Salmonella* organisms.

Outbreak in the Urban District

As the practitioners were requested to notify cases of sickness and diarrhoea it was possible to estimate approximately the magnitude of the outbreak. The total number of cases notified was 162, and 79 households were involved. Some of the known cases were very mild, and it is therefore probable that there were many more cases, which did not come to light as a doctor was not called in. The date of onset of the illness was stated to be Aug. 18 in 2 cases, Aug. 19 in 143 cases, and Aug. 20 in 15 cases; in 2 cases the date was not given. The age and sex incidence is shown in Table I.

TABLE I.—Age and Sex Incidence of Cases of Gastro-enteritis notified in the Knaresborough Urban District

Age	Cases	Females	Males
Under 5	35	21	14
5-9	23	12	11
10-14	16	4	12
15-24	24	19	5
25-34	23	21	2
35-44	15	10	5
45 and over	26	17	9
Totals	162	104	58

Outbreak at Farm G

On making investigations at the farm it was found that six persons were resident there: the farmer H. F., aged 70; his son-in-law T. P., aged 36; his three daughters, R. P., aged 36, J. B., aged 32, and W. F., aged 23; and his granddaughter, J. P., aged 9. Two farm labourers—H. R., aged 40, and C. K., aged 35—were employed, but lived with their families in the village and were supplied with milk from the farm. The farmer, his son-in-law, and his granddaughter were ill with sickness and diarrhoea. The other residents and the two labourers were well, and remained well. All the members of

the labourers' families, seven in number, were ill. Other cases were known to have occurred in the village among persons supplied with milk from the farm. Particulars of the cases connected with the farm are given in Table II.

TABLE II.—*Particulars of Patients Resident at or Associated with the Farm*

No.	Name	Sex	Age	Relation	Condition	Onset of Illness	Bacteriological Examination
1	H. F.	M	70	Farmer*	Ill	18/8, 9 p.m.	Positive
2	T. P.	M	36	Son-in-law*	Well	19/8, a.m.	Positive
3	R. P.	F	36	Daughter†	Well	—	Negative
4	J. B.	F	32	"	"	—	"
5	W. F.	F	23	"	"	—	"
6	J. P.	F	9	Grand-daughter	Ill	19/8, 4 a.m.	Positive
7	H. R.	M	40	Labourer*	Well	—	Negative
8	E. R.	F	44	Wife	Ill	18/8, p.m.	Positive
9	W. R.	F	19	Daughter	"	18/8, p.m.	Negative
10	H. R.	M	10	Son	"	18/8, p.m.	"
11	C. K.	M	35	Labourer	Well	—	"
12	E. K.	F	26	Wife	Ill	18/8, p.m.	Positive
13	J. K.	F	10	Daughter	"	18/8, p.m.	"
14	B. K.	F	7	"	"	18/8, p.m.	"
15	C. K.	M	2	Son	"	18/8, p.m.	"

Nos. 1 to 6 were resident at the farm; Nos. 7 to 15 were resident in the village.

*Milkier. †Milk distributor.

Production and Distribution of the Milk

At the farm there were 20 cows, two of which were dry. The cows were milked by the farmer, his son-in-law, and the labourer H. R. When the farmer and his son-in-law became ill the milking was continued by H. R., assisted by the other labourer, C. K. Milking was done by hand. The milk, of which about 36 gallons were produced daily, was distributed by the farmer's daughters R. P. and W. F. to about 600 registered customers in the urban district and 12 in the rural district, the number of households supplied being about 200. There was only one calf on the farm, and neither the calf nor any of the cows showed evidence or gave a history of enteritis. None of the cows had been recently added to the herd. There were no pigs at the farm and there had been no disease among the poultry.

Procedures taken to Prevent the Spread of Infection

When the farm was visited on the morning of Aug. 20 the evidence strongly pointed to the milk as the vehicle of infection, and the first problem which arose and required immediate decision was what steps should be taken with regard to the milk to preclude the possibility of the occurrence of further cases. At that time there was no bacteriological proof that the milk was infected. The results of bacteriological examinations, which had been started very late on the previous evening, had proceeded only far enough to indicate that a pathogenic organism was present in the faeces of some of the cases.

Two courses were open—namely, to prohibit the use of the milk for human consumption or to allow it to be used only after pasteurization and to be distributed only by persons unconnected with the farm. The former procedure would, if adopted, have involved the waste of a considerable amount of milk, which is a valuable and at the present time not too abundant food, besides causing financial loss to the farmer. In view of these considerations it was decided to allow the milk to be used after pasteurization.

On the afternoon of the same day arrangements were made with the local officer of the Ministry of Food and with the Milk Marketing Board to collect the milk at the farm, take it direct to a pasteurizing plant, and distribute it from there after pasteurization. By this arrangement the milk did not return to the farm. A supply was provided for the farmer's customers, and this was distributed by another retailer. The last delivery of milk direct from the farm was on the morning of Aug. 20. It was also arranged to examine the milk produced at the farm and specimens of faeces and urine of all persons resident at or connected with the farm. Those who had the disease were prohibited from taking part in the milking until declared free from infection, and the milkers were warned to exercise care in the cleansing of their hands and the dairy utensils.

A request was made to the Ministry of Agriculture to have the herd examined by one of its officers. An examination was

made on Aug. 23, and the veterinary officer reported that "several of the cows were found to be affected with cowpox, in some cases very severely, and the teats in these cases were a mass of sores, some of them being wet and running." The farmer was advised as to treatment of the condition, and was requested to call in his own veterinary surgeon to continue the treatment; to this he agreed. When it was subsequently found that a cow was excreting the organism in the dung, this animal was excluded from the herd and instructions were given not to allow its milk to be mixed with that taken to the pasteurizing plant or to be used for human consumption or fed to animals unless it had previously been boiled.

Bacteriological Examination

On Aug. 19 specimens of faeces from 8 patients in the urban district and a specimen of milk collected at the hostel were received for examination. Of these, 7 specimens of faeces and the specimen of milk were found to contain an organism of the *Salmonella* group. The milk was very heavily infected. Two loopfuls spread on a MacConkey plate showed after 24 hours' incubation more non-lactose-fermenting colonies than colonies of coliform organisms. The pathogenic organism was motile and fermented glucose, mannitol, and dulcitol with formation of acid and gas, but gas was at first not abundant. It did not ferment lactose or saccharose; it formed hydrogen sulphide but no indole. It was strongly agglutinated by polyvalent *Salmonella* serum.

The serological identification of the organism proved difficult. It was equally well agglutinated on the slide by *typhosum* O serum and by *aertrycke* O serum. This was probably due to the presence of an overlapping O antigen XII (Topley and Wilson, 1936). Agglutination to titre carried out in tubes showed a slightly higher titre with *typhosum* O serum. A weak but definite reaction with *Gaertner* H serum indicated that the organism probably belonged to the enteritidis subgroup. As the organism could not be placed nearer with the sera available, cultures isolated from one of the patients and from the milk were sent to Dr. Joan Taylor, of the *Salmonella* Reference Laboratory, Oxford, who identified them as *Salmonella dublin*.

The examination of the specimen of milk which was collected at the hostel was of interest as it showed not only that the milk was the vehicle of infection but also that it must have been infected on at least two occasions. The specimen was a sample of milk delivered at the hostel on the morning of Aug. 19. At that time all the children, the nurse, and her friend were ill and did not take any of that milk. The milk had not been handled by any of the inmates except the matron and cook, who had not been ill, and therefore it is very unlikely that it could have become infected after delivery at the hostel.

Specimens of faeces and urine from all the residents at the farm and from the two farm labourers and the members of their families were also examined. The organism was shown to be present in the faeces or urine of all the residents at the farm who had been ill, and of five of the seven members of the labourers' families who had been ill. It was found nine times in specimens of faeces and three times in specimens of urine. Cultures made from the material collected from the lesions of the cows suffering from cowpox showed only coagulase-positive golden staphylococci. Repeated examination of samples of bulked milk collected at the farm, of the water supply of the farm, and of water in a stagnant pond on the farm all gave negative results. Repeated examinations of the dung of the calf were also negative.

It is known that infections due to *S. dublin* are especially associated with calves and cattle (Savage, 1940). Conybeare and Thornton (1938) isolated *S. dublin* from the dung of an apparently healthy cow which was shown to have a high serum-agglutinin titre for that organism. In the present outbreak it was impracticable, owing to transport and other difficulties, to collect specimens of dung and blood of all members of the herd. It was possible, however, to obtain samples of milk from individual cows, and these were examined culturally and serologically. The cultures were negative in every case, but evidence of infection was obtained by investigating the agglutinin content of the milk. The individual samples of milk were mixed with rennet and the mixture was allowed

to stand on the bench until the whey had separated. Twofold dilutions of whey were prepared with 0.85% sodium chloride solution in a volume of 0.5 ml., the dilutions ranging from 1 in 2 to 1 in 256. Saline controls and normal milk controls were also set up at the time of the experiment. To all the tubes 0.5 ml. of a suspension of *S. dublin* was added. The opacity of this suspension was adjusted with normal saline solution until it was approximately the same as that of a standard suspension. The suspension was preserved by the addition of 0.4% of chloroform. All the tubes were incubated at 50° C. for two hours and allowed to stand on the bench overnight. The milk of Cow No. 10 was found to contain agglutinins for *S. dublin*, the titre being 1 in 32. The test was repeated with another specimen of milk of Cow No. 10, and a titre of 1 in 64 was obtained. The agglutination was of the flaky H type. The whey obtained from the milk of all the other cows did not agglutinate *S. dublin* in a dilution of 1 in 4. Subsequent examination of the dung of Cow No. 10 showed the presence of *S. dublin*. Two samples of dung were examined; in both an almost pure culture of *S. dublin* was obtained on direct plating on Leifson's medium, and many colonies were also detected on MacConkey medium. The identity of the organism was confirmed by Dr. Joan Taylor.

Discussion

Three extensive outbreaks of milk-borne gastro-enteritis due to *S. dublin* have been reported in this country. In the first two outbreaks, which occurred in Dundee in 1926 and 1927 and were reported by Tulloch (1939), the infection was traced to a cow that was ill. In the Wilton outbreak (Conybeare and Thornton, 1938) and in the present one, however, the absence of evidence of illness among the cows presented the problem of finding the animal carrier. Conybeare and Thornton discovered the carrier by examining the antibody content of blood samples of individual cows. They found that about 50% of sera gave an agglutinin titre of 1 in 25. The sera of three cows gave a titre of 1 in 400 or higher, and the dung obtained from one of these cows yielded *S. dublin* on cultivation.

In the present outbreak the search for the carrier was made by determining the agglutinin content of the milk. It was found that milk from healthy cows did not contain any agglutinins for *S. dublin* and that even a low titre of agglutinins in milk was indicative of infection. It appears, therefore, that milk is a suitable material for serological tracing of carriers of *S. dublin* not only because it is more easily obtained than blood but also because non-specific agglutinins for *S. dublin* are not usually present.

How the milk became the vehicle of infection is a matter of conjecture. As the dung of the carrier cow contained the organism in large numbers it seems probable that the milk became contaminated as a result of faulty methods of production at the farm. On the other hand, although the milk of this cow was repeatedly examined with negative results, the possibility of intermittent excretion of *S. dublin* in the milk cannot be excluded.

Summary

An outbreak of milk-borne gastro-enteritis due to *Salmonella dublin* is described. At least 162 people were affected. There were no deaths. The source of infection was an apparently healthy cow which was excreting large numbers of the organism in the dung. The carrier cow was identified by the agglutinin content of its milk. The milk of normal cows did not possess any agglutinins for *S. dublin*.

We are indebted to Dr. T. N. V. Potts, the County Medical Officer, and to Drs. D. F. Dobson and J. W. Forbes of Knaresborough for permission to publish an account of the outbreak. We thank the Divisional Inspector of the Ministry of Agriculture, Mr. W. T. MacGregor, and his assistant, Mr. J. M. McKellar; the County Sanitary Inspector, Mr. A. Brook; the local Sanitary Inspectors, Mr. H. Eatough and Mr. A. E. W. Lupton, for co-operation and assistance in the investigation; and also Mr. S. J. Denyer, Chief Technician at the County Laboratory, for technical assistance.

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THE EARLY TREATMENT OF WOUNDS OF THE CHEST IN THE MIDDLE EAST

BY

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The provision by the Army Medical Services of special teams for the treatment of wounds of the chest demands an explanation, if not an apology, from the general physician who has the temerity to express his opinions on this subject. During the first and second battles of El Alamein, in July and Oct., 1942, a number of battle casualties with wounds of the chest were admitted to a general hospital, at that time less than a hundred miles behind the line. This hospital played the part of a casualty clearing station, although retaining greater facilities for investigation and treatment, and the management of these cases fell to my lot as medical specialist. Thus this paper records the experience of a general physician in the immediate treatment of thoracic casualties without the expert assistance of a thoracic surgeon. The problems were those commonly confronting the medical specialist in a casualty clearing station, and they differed from the problems of the thoracic team in the more leisured atmosphere of the base hospital. Time was limited; only treatment urgently indicated could be undertaken; and the immediate aim was to ensure that the patient had recovered sufficiently to withstand the rigours of evacuation to the chest centre.

The Material

The material which forms the basis for these observations consists of 127 consecutive battle casualties with penetrating wounds of the chest. From the first battle wounded were admitted unselected, but from the second the hospital received only those whose condition was too precarious to allow of immediate evacuation. As this type of casualty is often gravely ill, chest wounds formed 13% of the second group and only 4.6% of the first. The majority had passed through a surgical unit, but treatment had commonly been confined to dressing and the administration of morphine. 46% were admitted within 48 hours and 72% within 72 hours of wounding. In all cases radiographs were taken, and it was possible to hold patients in hospital for as long as ten days when necessary; in these respects conditions differed from those usually operative in a casualty clearing station. No "follow-up" was practicable, but, through the courtesy of Major A. Logan, R.A.M.C., O.C. No. 1 Surgical Team for Chest Surgery, the ultimate fate of the majority is known.

An analysis of the arms of the Service from which these casualties were drawn shows, as would be expected, that the infantry suffered most heavily. The composition of the series

TABLE I.—The Nature of Missile in 63 Cases of Penetrating Wounds of the Chest

Nature of Missile	No. of Cases
Shell fragment	34 (54.0%)
Bullet (rifle, m.g., or revolver)	17 (27.0%)
Mortar-bomb fragment	6 (9.5%)
Land-mine fragment	3 (4.7%)
Aerial-bomb fragment	1 (1.6%)
Hand-grenade fragment	1 (1.6%)
Unexploded 50-mm. A.P. shell	1 (1.6%)

was: infantry, 72.5%; artillery, 13.4%; R.A.C., 3.9%; R.E., 3.9%; R.A.S.C., 3.9%; R.A.O.C., 1.6%; R.C.O.S., 0.8%. The nature of the missile in the 63 cases in which it was known is set out in Table I.

TABLE II.—The Intrathoracic Condition, on Admission to Hospital, of 127 Cases of Penetrating Wounds of the Chest

Intrathoracic Condition	No. of Cases	No. Fatal
Haemothorax and haemopneumothorax	88 (69.4%)	5
Pneumothorax	5 (3.9%)	—
Pulmonary haematoma	14 (11.0%)	—
Atelectasis	5 (3.9%)	—
Lung abscess	2 (1.6%)	1
Thoraco-abdominal injuries	13 (10.2%)	6