a year before the diagnosis was made at necropsy. Another animal, whose symptoms began two years previously, died of bilateral pulmonary tuberculosis with cavitation associated with liver lesions. When Griffith (1911) was conducting the modification experiments on the bovine type of *M. tuberculosis* for the Royal Commission on Tuberculosis, he fed 19 dogs an average dose of 62 mg. of culture. These animals all had to be killed after an average period of 206 days despite the fact that at necropsy all were found to have lesions of varying extent. Gunn *et al.* (1943) report similar findings. One of their dogs was found to have an active lesion more than three years after artificial infection.

From the foregoing it can be seen that little reliance can be placed on the quick death of the animal as a convenient form of natural self-limitation of a source of infection.

Animals in Contact with Sputum-positive Humans

The second part of the results was based on the investigation of the 20 dogs and 15 cats living in contact with sputum-positive humans, and here the abnormal findings in the two dogs (MR14 and MR15A) and the two cats (MR26 and MR30) must raise the question of the advisability of allowing dogs and cats to live in tuberculous households.

The possibility must be considered that the bacilli recovered had been ingested and that the positive cultures were simply an indication of their transit through the bowel. Floyd and Page (1943) found that *M. tuberculosis* could survive exposure to the gastric juices of dogs for periods of one to twelve hours without the loss of pathogenicity noted in guinea-pigs after longer periods. Kuwabara (1938), injecting 5 mg. of human-type bacilli intravenously into cats, noted a few bacilli in the spleen, liver, and lungs two months after the injection, but no bacilli at three months. There were no associated histological changes. It would thus seem that bacilli can be present for at least eight weeks in animals with natural resistance without causing lesions. In the present series, both dogs and one of the cats, MR30, had been separated from the household source of infection for more than three months at the time of examination.

It might be argued that these findings represented an early stage in the disease in dogs and cats, a stage about which there is little, if any, factual knowledge.

At present it is not considered advisable to speculate on the exact significance of these findings, but there is enough evidence to warrant continuation of the survey in this area, and to draw the attention of others to this interesting problem. The correct interpretation, indeed substantiation, must await the outcome of further study.

The combined results indicate the existence of a small field in which full investigation may produce findings having a restricted application in the epidemiology of tuberculosis.

Summary

An account is given of an investigation into the interrelationship of tuberculosis between humans and dogs and cats.

The human contacts of 14 tuberculous dogs underwent *x*-ray examination and 9 significant cases of tuberculosis were found among them.

The dogs and cats owned by 37 patients with active tuberculosis were examined, *M. tuberculosis* being recovered from swabs of the alimentary tracts of two dogs and two cats.

Further investigation of all aspects of the subject would be materially assisted by a wider appreciation of the possibility of the occurrence of tuberculosis in dogs and cats.

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CORRELATION OF HUMAN AND ANIMAL RINGWORM IN WEST OF SCOTLAND*

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As a result of reports in the medical and veterinary press of the existence of an animal reservoir for many human ringworm infections a committee on human and animal dermatomycoses was formed in Glasgow in November, 1954. This report by a subcommittee appointed to investigate cases of human ringworm suspected to be of animal origin covers the first two years of the work. During the first year the survey area consisted of South and West Glasgow, the county of Ayr, and parts of the counties of Dunbarton, Renfrew, and Stirling. After a year this area was extended to include the whole of Glasgow and the South-west of Scotland.

Method

At first dermatologists who diagnosed ringworm of possible animal origin submitted a specimen for identification and asked the patient to have any suspected animal

*A report to the Committee on Human and Animal Dermatomycoses. Members of the Committee: Professor W. L. Weipers (chairman), Dr. R. W. Carslaw, Dr. T. Cochrane, Professor J. W. Emslie, Dr. A. Girdwood Fergusson, Mr. J. C. Gentles, Dr. W. A. Greig, Mr. I. M. Lauder, Mr. J. G. O'Sullivan, Mr. A. Pottie, Dr. J. F. Ferguson Smith, Dr. Mary Smith, Dr. J. Sommerville, Mr. A. Thomson, and Mr. A. L. Wilson.

examined by a veterinary surgeon. Later it was found more satisfactory to request a veterinary surgeon to visit the suspected premises and to forward a specimen from any animal with suspicious skin lesions. By arrangement with the West of Scotland and Ayrshire Divisions of the British Veterinary Association these examinations were carried out free of charge. Veterinary surgeons were also asked to advise any persons whom they encountered in contact with ringworm-infected animals and who had suspicious skin lesions to seek medical advice. Animal specimens were submitted mainly by veterinarians in private practice, but in Ayrshire this was done by the veterinary investigation officer, and in the vicinity of Glasgow the small animal suspects were examined by veterinary members of the sub-committee. Co-operation was good, and few named contact animals were not investigated, particularly during the latter part of the survey.

Correlation of Cases and Clinical Considerations

A summary of the laboratory results from the 163 cases in which there was some evidence that a human ringworm infection had been contracted from an animal is given in Table I. Zoophilic dermatophytes were isolated from 109

TABLE I.—*Summary of Results of* 163 *Cases When an Animal Was Suspected to be the Source of a Human Ringworm Infection*

		Animals									
		T. verrucosum	*T. mentagrophytes*	*M. canis*	*M. audouini*	*T. rubrum*	*T. sulphureum*	Micropositive Only	Negative	No Specimen	Totals (Human)
Humans	*T. verrucosum* ..	35*	—	—	—	—	—	4	6	37	82
	T. mentagrophytes	2†	1*	—	—	—	—	—	2	10	15
	M. canis	3†	—	6*	—	—	—	—	—	3	12
	M. audouini ..	—	—	—	—	—	—	—	1	—	1
	T. rubrum ..	—	—	—	—	—	—	—	—	1	1
	T. sulphureum ..	1†	—	—	—	—	—	—	5	—	6
	Micropositive only	7	—	—	—	—	—	1	1	2	11
	Negative ..	6	—	—	—	—	—	1	2	9	18
	No specimen ..	17	—	—	—	—	—	—	—	—	17
	Totals (animal) ..	71	1	6	—	—	—	6	17	62	163

N.B.—The human data are read from left to right; animal data from top to bottom.

* Cases when the source was confirmed by culture of the same dermatophyte from both human and animal.

† Cases when different dermatophytes were cultured from human and cited animals.

(67%), and anthropophilic species from 8 (5%) of the individuals. Specimens from 11 (7%) persons were positive by microscopy only, and in 18 (11%) cases no evidence of infection was obtained by laboratory examination. The remaining 17 (10%) persons from whom specimens were not received were reported to have suspicious skin lesions and to be in contact with animals proved to be infected.

Cultures were obtained from 78 (48%) of the suspected animals, 6 (4%) were positive by microscopy, and in 17 (10%) cases the animals were not found to be infected. In the remaining 62 (38%) cases specimens from the animal were not received, in 11 of them because animal contact was denied.

Generally only one human infection could be related to each of the animal premises, but this was not always so, as 21 infections were traced to only eight premises. On the other hand, more than one animal was usually affected in each of the premises investigated. Fifteen cats and 14 dogs were proved to be infected on only two premises containing in all 24 cats and 19 dogs, and similarly on 96 farms there were 726 cattle clinically affected. The fungi isolated were: *Trichophyton verrucosum,* var. *discoides,*† *T. mentagrophytes, Microsporum canis, M. audouini, T. rubrum,* and *T. sulphureum.*

†The only variety isolated during the period covered by this report.

Trichophyton verrucosum

This fungus is rarely recovered from animals other than bovines, and infection of these animals with other dermatophytes seldom occurs. It is clear therefore that, although the correlation of a human infection with an animal source may be considered indisputable only where a culture of the same dermatophyte is obtained from both, a culture of *T. verrucosum* from a human, together with a history of contact with infected cattle, provides strong presumptive evidence that cattle were the source of infection.

Of the 82 cases where *T. verrucosum* was isolated from a human, 35 suspected animals were proved to be infected with the same dermatophyte, four were found to have a large-spored ectothrix infection, and six were known to have been clinically affected although free from infection when examined. Specimens were not obtained from 33 bovines, although they were reported to have been affected. On four occasions contact with animals was denied; with the exception of these four cases there is little doubt that all of the *T. verrucosum* infections in humans originated from cattle. Three cases were indirect contacts; in two of them the infection was presumably carried by a close relative, and on the other occasion it may have arisen from contact with infected woodwork.

On 30 occasions *T. verrucosum* was isolated from cattle, and humans in contact with the animals were reported to have ringworm. Specimens from seven of the humans were positive by microscopy, six were negative on laboratory examination, and specimens were not received from the remaining 17 persons.

Seasonal Incidence

The frequency of the infection in humans over the two-year period is shown in Table II, from which it can be seen that the highest rate occurred in January, February,

TABLE II.—*Monthly Incidence of Human Infections with T. verrucosum Over the Two-year Period*

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
10	12	16	4	8	19	0	5	0	5	2	1	82

and March and that there was another peak rate in June. Only 16% of the infections occurred during the last six months of the year.

Since most of the animal material was selected it is not possible to draw conclusions regarding a seasonal incidence in bovines. During the winter months farm-workers are in close contact with infected animals and the high incidence of ringworm in humans from January to March is not unexpected. From April, however, the animals are out at grass, so that frequency of contact with humans is much reduced. A possible explanation of the high human incidence in June is that the individuals become infected from byres and calf-pens which have housed infected animals, as after the cattle have gone to grass it is usual for the pens to be cleaned down and the accumulated manure to be put out.

Clinical Data

Human.—Detailed clinical information was available in 66 cases of *T. verrucosum* infection. The affected adults were farm-workers with three exceptions, of whom two had

TABLE III.—*Clinical Details of T. verrucosum Infection in* 66 *Humans* (53 *Males,* 13 *Females*)

Age in Years	No. of Cases	Site of Lesions*	
0–5	5 (7·6%)	Upper limbs ..	32 (48·5%)
6–10	8 (12·1%)	Lower ,, ...	5 (7·6%)
11–15	16 (24·2%)	Trunk	10 (15·2%)
16–20	13 (19·7%)	Scalp	14 (21·2%)
21–30	9 (13·5%)	Face	16 (24·2%)
31–40	6 (9%)	Neck	6 (9%)
41–50	6 (9%)		
51–60	3 (4·5%)		

* There were two lesions in 16 cases and three lesions in 31 cases.

indirect contact with cattle and the third could not suggest any possible source of infection; all the children except one lived or played on a farm. The age incidence as shown in Table III does not permit conclusions to be drawn regarding the question of acquired immunity in older farm-workers, since no information concerning the number at risk in each age group is available. For the same reason no comment can be made on the sex incidence. The arms and face were the most commonly affected areas. Kerion reaction was noted in 7 children and 16 adults; in the children, except in one case, such lesions were found only on the scalp, while in adults either the region of the beard or that of the limbs was affected. Kerion formation did not occur in adult females. On the other hand, non-inflammatory lesions were present in 20 children, in 5 adult males, and in 5 adult females, while inflammatory lesions occurred in 9 children, in 10 adult males, and in 1 adult female.

Animal.—Information was obtained regarding 77 bovines infected with *T. verrucosum*. Although the majority of cases occurred in young stock, 6 (8%) of the animals were 3 years and over (Table IV). This age distribution has already been noted by Sellers, Sinclair, and La Touche (1956). The part of the animal most frequently affected was the head, particularly the regions of the eye, the ear, and the muzzle, and there were lesions on the neck in over 50% of cases. In addition to the typical light-grey plaques of mature lesions there were numerous early stages which could be felt through the hair and which became obvious only when the hair was removed. Each of these lesions was a small discrete aggregation of inspissated yellowish exudate which clumped together the bases of a group of hairs. On removal of the firmly adhering exudate a moist red surface was revealed and the underlying skin was palpably thickened. All of these lesions did not develop to the mature stage.

TABLE IV.—*Clinical Details of T. verrucosum Infection in 77 Bovines*

Age in Years	No. of Cases	Site of Lesions*	
Under 1	45 (58·2%)	Head	61 (79%)
1–	16 (20·7%)	Neck	41 (53%)
2–	10 (12·9%)	Shoulders	12 (15·5%)
3 and over	6 (7·7%)	Back	18 (23·5%)
		Lumbar region ..	12 (15·5%)
		Tail	7 (9%)

* 61 animals were infected on two or more sites.

Trichophyton mentagrophytes

This dermatophyte is known to have a wide range of animal hosts, and correlation of a human infection with a source is not possible unless a culture is obtained from the suspected animal. The 15 cases of human infection with *T. mentagrophytes* were isolated ones and each originated from a separate source. Eight of the affected individuals suggested animals as the probable source of their infection, and the results of investigation of the animals were: *T. mentagrophytes* (1), *T. verrucosum* (2), negative (2), no specimen received (3). The seven remaining persons denied contact with animals, and thus only one animal source was confirmed. All the isolates were of the typical powdery strain with the exception of one *niveum* strain which was isolated from a child of 2 years for whom no animal contact was known.

There has been considerable speculation on the source of *T. mentagrophytes* infections in humans, and Carlier (1954) and Rook (1956) were apparently convinced that cattle were responsible for infection of a number of their patients. There is, however, only one previously published record of the isolation of *T. mentagrophytes* from cattle in Britain (Muende and Webb, 1937) as opposed to the isolation of *T. verrucosum* exclusively on 41 occasions by Ainsworth and Austwick (1955), on 36 occasions by Mortimer (1955), and from animals on 28 farms by Sellers *et al.* (1956). In the U.S.A., Georg (1956) records only one isolation of *T. mentagrophytes* but 50 of *T. verrucosum*. The dermatophytes isolated from cattle ringworm cases in the West of Scotland over a four-year period were *T. verrucosum* (99) and *T. mentagrophytes* (1) (Gentles and O'Sullivan, 1957). It is clear, therefore, that cattle ringworm due to *T. mentagrophytes* is rare and that cattle are unlikely to be a frequent source of this type of infection in humans.

Two of our human cases did, in fact, suspect cattle as the probable source, but only *T. verrucosum* was isolated from the animals, and it is of interest that Georg (1956) gives details of two cases when she obtained a like result. She has suggested that rodents are frequent hosts of *T. mentagrophytes*, and Feuntes, Bosch, and Boudet (1954) present evidence that on occasion rodents and cats may be clinically normal carriers of this infection. Our only confirmed case of *T. mentagrophytes* ringworm linked a boy with his pet mouse, which had cultural but no clinical evidence of ringworm. Another of our cases occurred in an individual who had frequent contact with laboratory rodents which had been apparently free from infection but were destroyed before they could be examined. Two dogs from which we could obtain no evidence of infection might possibly have been other examples of clinically normal carriers, but it is more likely that they were instances of a wrong source having been suspected.

Clinical Data

Twelve of the patients were children and three were young adults, and the sites affected were: scalp (6), upper limbs (5), lower limbs (1), neck (2), buttocks (1), and fingernails (1). With regard to the six cases of scalp infection kerion reaction was present in two of them, non-inflammatory lesions were noted in two others, and information was not available in the remaining two. On the other sites affected, seven lesions were non-inflammatory and two were inflammatory.

Microsporum canis

It is generally assumed that the majority of *M. canis* infections in man originate from cats and dogs, and our findings from 12 cases are not at variance with this view. These animals were confirmed as the source of infection for six patients. Three other persons were in close contact with a cat, which was not available for examination, and the three remaining people, members of the same family, suspected a bovine source; only *T. verrucosum* was isolated from the cattle, and a small animal reservoir could not be traced.

Clinical Data

Human.—The sites of infection in the 12 patients (5 adults and 7 children) were as follows: scalp (6), forearm (4), trunk (1), neck (1). One of the scalp infections was unusual in that the patient was an adult (male, aged 33) and that the infection, which was only mildly inflammatory, continued for nine months in spite of local treatment.

Animal.—Only two premises were traced as the source of human infections with *M. canis*, and there were 15 cats and 14 dogs affected. One outbreak involved an entire kennel of boxers, and the 11 pups which were seen initially when they were 6 weeks old had the most severe and widespread lesions; two adult dogs were also infected. The animals were examined at intervals over a period of six months, by which time the infection could no longer be demonstrated. The lesions in the young animals when first examined were mainly on the almost hairless abdominal skin and consisted of circular areas up to 1 in. (2.5 cm.) in diameter, each with a raised inflammatory periphery. Significant fluorescence under Wood's light was not seen at this stage. In seven days the weal was no longer evident, but its site could be recognized by slight exfoliation. Under Wood's light, evidence of widespread infection was then noted and small bare spots had appeared on the head, body, and limbs. Seven to 14 days later the oldest lesions were clearly defined. Some of these had reached 1 in. (2.5 cm.) in diameter, many had developed grey discoloration, and some were raised above the surface of the surrounding skin. At this stage numerous

new lesions became apparent as palpable small discrete spots of crusted exudate, clumping the bases of the hairs. The crusts did not fluoresce until they were removed, when a few hair bases protruding from the underside of the scab were seen to fluoresce. Many such small lesions became bare but did not increase in size, while the original lesions developed darker pigmentation and the skin over them became thickened, although remaining fairly smooth. One pup kept in a veterinary hospital appeared to clear in three months. The remainder of the litter developed a systemic viral infection about six weeks after ringworm had been diagnosed. The fungous infection became much more widespread and did not disappear until six months after onset. The protracted course may have been associated with the concurrent infection.

On the other premises there were 24 cats and six dogs, all of which were examined by Wood's light, and the infection was found in 15 cats and one dog. The cats were in poor condition owing to a chronic respiratory infection and concurrent external parasitism. The severity of the ringworm varied from discrete lesions of ¼–½ in. (6–13 mm.) in diameter to a generalized involvement of the head, body, and limbs. The claws were not affected and the generalized condition occurred in three of the animals, two of which were over 5 years of age.

In the two outbreaks six adult cats and three adult dogs were affected, and, although there can be little doubt that young animals are more susceptible, we do not agree with Beare and Cheeseman (1953) that *M. canis* infections in animals are not usually seen after puberty.

Anthropophilic Dermatophytes

Eight individuals who suspected animals as the probable source of infection were found to be infected with anthropophilic dermatophytes. *T. sulphureum* was isolated from six persons. One of the suspected animals, a bovine, was infected with *T. verrucosum*, and the other animals, either cats or dogs, were free from infection. A finger-nail infection with *T. rubrum* was at first thought to have been derived from a rabbit, but was found to have originated from the patient's feet. A scalp infection in a young girl was considered likely to have been acquired from a cat which had bald patches on its head; the cat was free from infection and the dermatophyte cultured from the girl was *M. audouini*. It is clear that without cultural investigation these cases might well have been attributed to the suspected animal source.

Comment

While it cannot be claimed that all cases of ringworm of animal origin in humans in this area are included in this report, it is nevertheless believed that the results are significant. These indicate that cattle are mainly responsible for human infections with animal-type fungi in the West of Scotland. This is contrary to the statement of Mortimer (1955), that the domestic pet is the most frequent source of these infections in Britain, a view supported by the results of the surveys of Walker (1950) and Carlier (1954). In our series small animals were suspected to be the probable source of infection on only 25 occasions and confirmed as the source on seven of them (Table V). This would appear to be a surprisingly low number of cases, but there is other evidence that ringworm in small animals is not common in this area. All cats and dogs, mostly strays, brought for destruction to a veterinary clinic in Glasgow in September, 1955, were examined by one of us (J. G. O'S.). The animals were examined clinically and by Wood's light, scrapings being taken from any suspicious areas. There was no evidence of dermatophyte infection in any of the 103 cats and 16 dogs so examined.

It should be noted, moreover, that Whittle (1956) states that there has been an apparent increase in the number of human infections with *T. verrucosum* in recent years. This may be a result of the greater amount of laboratory work now being done, but it is also possible that there has been a true increase in *T. verrucosum* infections in humans.

With regard to these infections our clinical findings appear to support the theory that involvement of the deeper hair follicles plays an important part in kerion formation (Whittle, 1956). In women and children, apart from kerion formation on hair-bearing areas, *T. verrucosum* infections apparently occur most commonly as non-inflammatory reactions. Our observations afford no evidence that the type of lesion (kerion, inflammatory or non-inflammatory) can be related to its duration. The arms are commonly affected, and this is not suprising, since farm-workers come into frequent contact with the neck and head of cattle when tying the animals.

Although it has been confirmed that animals form a large reservoir of ringworm infection, evidence has also been provided that a number of human infections may be wrongly attributed to an animal source or to a wrong species of animal. Full cultural investigation should obviate these errors.

TABLE V.—*Details of Cases When a Small Animal Was Named as the Source of a Human Infection*

Human		Animal		
Laboratory Result	No. Affected	Laboratory Result	No. Affected	Animal Named
M. canis	3	*M. canis*	13	Dog
M. canis	3	,, ,,	15	Cat
			1	Dog
	3	No specimen received	—	Cat
T. mentagrophytes	1	*T. mentagrophytes*	1	Mouse
T. mentagrophytes	2	Negative	—	Dog
T. mentagrophytes	3	No specimen received	—	Dog, cat, mouse
M. audouini	1	Negative	—	Cat
T. sulphureum	5	,,	—	Cat, dog
T. rubrum	1	No specimen received	—	Rabbit
Micropositive only	1	Negative	—	Dog
Negative	2	,,	—	Dog, cat
Total	25		30	

Summary and Conclusions

The results are given of an investigation in the West of Scotland of 163 cases of human ringworm infection which were suspected to be of animal origin. Dermatophytes were cultured from 117 (72%) of the humans, and the isolates were: *T. verrucosum*, 82; *T. mentagrophytes*, 15; *M. canis*, 12; *T. sulphureum*, 6; *T. rubrum*, 1; *M. audouini*, 1. From 78 (48%) suspected animals, cultures were obtained of: *T. verrucosum*, 71; *T. mentagrophytes*, 1; *M. canis*, 6.

On 42 (26%) occasions the same dermatophyte was cultured from the human and the suspected animal; on 5 (3%) a different zoophilic dermatophyte was isolated from each source; and in 8 (5%) instances the human infection was caused by an anthropophilic fungus. Cattle were found to form the main animal reservoir of infection, and there were 78 (48%) confirmed cases. Only 7 (4%) human infections were traced to a small animal source. None of the human infections with *T. mentagrophytes* was found to originate from cattle.

It is confirmed that in this area animals form a reservoir of ringworm infection. Cattle rather than small animals—for example, domestic pets—are the main source of human infection.

We are indebted to the staffs of the Departments of Dermatology of the Ayrshire Group and Dumfries and Galloway Hospitals, the Southern General and Stobhill Hospitals, and the Victoria and Western Infirmaries, Glasgow, and of the Veterinary Investigation Department, Auchincruive, Ayrshire, for their assistance. We thank Miss C. O. Dawson and Miss F. Overend, of the Departments of Bacteriology and Veterinary Pathology of the University of Glasgow, for laboratory assistance, and also the general medical practitioners and the members of the West of

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ADDENDUM.—Since this paper was written a further 44 cases have been investigated. From humans with suspected animal ringworm the laboratory results were: *T. verrucosum*, 31; *T. mentagrophytes*, 3; *T. rubrum*, 1; *T. sulphureum*, 3; micropositive, 5; negative, 1. The results from specimens obtained from 23 of the animals were: *T. verrucosum*, 11; *T. equinum* and *M. equinum*, 1; micropositive, 4; negative, 7. Horses were given as the source of two human infections which were positive by microscopy only. *T. verrucosum* was isolated from one of the horses and both *M. equinum* and *T. equinum* from the other.

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INFANTILE HYPERCALCAEMIA WITH KERATOPATHY AND SODIUM DEPLETION

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Infantile hypercalcaemia, a condition which presents with failure to thrive, is known to occur in two forms, the benign (Lightwood, 1952) and the severe (Schlesinger, Butler, and Black, 1956). The essential feature in both forms of this condition is the raised serum calcium level, and, although the cause of this remains uncertain, the symptoms of anorexia, vomiting, and failure to thrive are ascribed to this increase in the serum calcium.

Treatment, therefore, is directed towards bringing about a fall in the serum calcium level, and to this end the child's intake of calcium is reduced. A low calcium milk, a proprietary preparation of which is now available ("locasol"), is usually given and no vitamin D supplements are allowed. In the case described below treatment in this way was successful in bringing about a fall in the serum calcium level, but was followed by a marked degree of sodium depletion. The case is also unusual in that during the course of the illness a band keratopathy developed, and, while this has been described as occurring in a number of conditions associated with a raised serum calcium level (Albright and Reifenstein, 1948), it does not appear to have been described hitherto in a case of infantile hypercalcaemia.

Case Report

The patient was first seen at the age of 1 week, when he presented with many extensive areas of subcutaneous fat necrosis of typical distribution—the external surfaces of the limbs, the buttocks, and the posterior part of the chest wall being affected. He seemed otherwise well at that time, but his general progress thereafter was unsatisfactory, so that by the time he was 3 months old he was only 9 oz. (255 g.) above his birth weight. He then developed a bilateral otitis media and, a few days later, persistent vomiting, which necessitated his admission to hospital.

He was pyrexial, temperature 105° F. (40.6° C.), he had bilateral otitis media, and one of the areas of fat necrosis situated in the left deltoid region was now fluctuant and evidently the site of a secondary infection. This subsequently had to be incised, and about 1 oz. (28 ml.) of thick yellow pus was evacuated. Swabs were taken of the aural discharges and a heavy growth of *Staphylococcus aureus*, coagulase-positive, was obtained. This organism was sensitive to penicillin, streptomycin, chloramphenicol, erythromycin, and the tetracyclines.

He was treated with intramuscular penicillin, 100,000 units six-hourly, intramuscular streptomycin, 100 mg. twelve-hourly, and sulphadiazine, 0.25 g. six-hourly. Initially he appeared to respond, but within 48 hours had developed head retraction, and a lumbar puncture showed the cerebrospinal fluid to be opalescent. Analysis of this gave the following results: leucocytes, 300 per c.mm., 70% of these being lymphocytes; protein, 100 mg. per 100 ml.; chlorides, 675 mg. per 100 ml.; sugar, 62 mg. per 100 ml. The culture was sterile.

He remained acutely ill for about two weeks, during which time he had several convulsions, and he was intermittently febrile. Treatment was continued with chloramphenicol and later with oxytetracycline, and the C.S.F. became normal in every respect.

It was thought likely that he had had an intracranial thrombophlebitis, and his vomiting was at first ascribed to the effects of this. But not only did he continue to vomit intermittently, he also became increasingly fretful, anorexic, and constipated. His urine contained a trace of albumin with an occasional granular and hyaline cast, and examination of his blood on August 8, 1956, by which time he was 4½ months old, gave the following results: serum calcium, 20 mg./100 ml.; serum phosphorus, 5.2 mg./100 ml; alkali reserve, 56.7 vols per 100 ml.; serum sodium 330 mg./100 ml.; serum potassium, 20.5 mg./100 ml.; serum chloride, 625 mg./100 ml.; urea, 64 mg./100 ml.; blood cholesterol, 182 mg./100 ml.

A diagnosis of infantile hypercalcaemia was now made and he was started on treatment with locasol. One week later the serum calcium had fallen to 13.5 mg. per 100 ml. and, after a further week, to 11.3 mg. On all subsequent occasions the serum calcium was found to be within normal limits.

In spite of the fact that his serum calcium remained normal, his symptoms showed no improvement. He remained fretful, anorexic, and constipated. It was possible to induce him to take only in the region of 20 oz. (570 ml.) of milk a day, although he was thirsty and would readily take extra drinks of water. He showed no consistent gain, his weight fluctuating between 10 and 11 lb. (4.5 and 5 kg.).

On October 31 the electrolytes were checked once more. The findings were within normal limits, serum sodium being 310 mg. per 100 ml. When these determinations were repeated on January 1, 1957, it was found that there had been a marked fall in the serum sodium level to 285 mg. per 100 ml.

It was decided that, without any other change in his feeding regime, added sodium chloride should be given, and this was done by making up the feeds of locasol with one-fifth normal saline instead of with distilled water. This increased his intake of sodium chloride by approximately 1 g. a day. There was an immediate change, which was apparent first in the child's behaviour. He became a happy, friendly, and responsive infant. He also ceased vomiting, his appetite increased, until he was taking 40 oz. (1,140 ml.) of milk a day. When solids were introduced into the diet, these too were taken well and the sodium chloride supplement was discontinued. His weight increased steadily during the next six weeks, the increase averaging 12 oz. (340 g.) a week. His serum sodium level at the end of a week had